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OPERATOR'S MANUAL

RADIO TEST SET AN/URM-44

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TECHNICAL MANUAL

OPERATOR'S MANUAL, RADIO TEST SET AN/URM-44

TM 11-6625-412-10
CHANGES NO. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *3 October 1963*

TM 11-6625-412-10, 24 March 1961, is changed as follows:

Page 1. After paragraph 1-1 add paragraphs 1-1.1 and 1-1.2:

1-1.1. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc.) and the latest changes to and revisions of each equipment publication.

1-1.2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J. One information copy will be furnished to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).

Page 17. After paragraph 3-8, add:

SECTION III.1

OPERATOR'S MAINTENANCE

3-1.1. Scope of Maintenance

The maintenance duties assigned to the operator of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions.

a. Daily preventive maintenance checks and services (par. 3-1.4).

b. Weekly preventive maintenance checks and services (par. 3-1.5).

c. Cleaning (par. 3-1.6).

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3-1.2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 3-1.4, 3-1.5, and 3-1.6 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (par. 3-1.4 and 3-1.5) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the references column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

3-1.3. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the radio test set are required daily and weekly. Paragraphs 3-1.4 and 3-1.5 specify the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition) and weekly, respectively.

3-1.4. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness	See that the equipment is complete (par. 1-28).	Sig. 7 and 8 AN/URM-44.
2	Exterior surfaces ..	Clean the exterior surfaces, including the panel and meter glasses (par. 3-1.6). Check all meter glasses and indicator lenses for cracks.	
3	Connectors	Check the tightness of all connectors.	
4	Controls and indicators.	While making the operating checks (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also, check the meters for sticking or bent pointers.	
5	Operation	Operate the equipment according to paragraph 3-3.	Par. 3-6 and Section IV.

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3-1.5. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables.....	Inspect cords, cables, and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	
2	Handles and latches.	Inspect handles, latches, and hinges for looseness. Replace or tighten as necessary.	
3	Metal surfaces	Inspect exposed metal surfaces for rust and corrosion.	

3-1.6. Cleaning

Inspect the exterior of the radio test set. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

Warning: Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame.

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with Cleaning Compound (Federal stock No. 7930-395-9542).

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: Do not press on the meter face (glass) when cleaning; the meter may become damaged.

d. Clean the front panel, meter, dial faces, and control knobs; use a soft clean cloth. If necessary, dampen the cloth with water and mild soap.

Page 25. After section IV, add:

APPENDIX
REFERENCES

Following is a list of applicable references that are available to the operator of the equipment.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SIG 7 & 8, AN/URM-44	Test Set, Radio AN/URM-44.
TM 38-750	The Army Equipment Record System and Procedures.

By Order of the Secretary of the Army:

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NG: None.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *24 March 1961*

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WARNING

This equipment employs high voltages (2,000 volts) which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside the equipment unless the power cord is disconnected. Although bleeder circuits are used to prevent capacitors from retaining charges after the power has been disconnected, always discharge and ground circuits before touching them in order to avoid casualties.

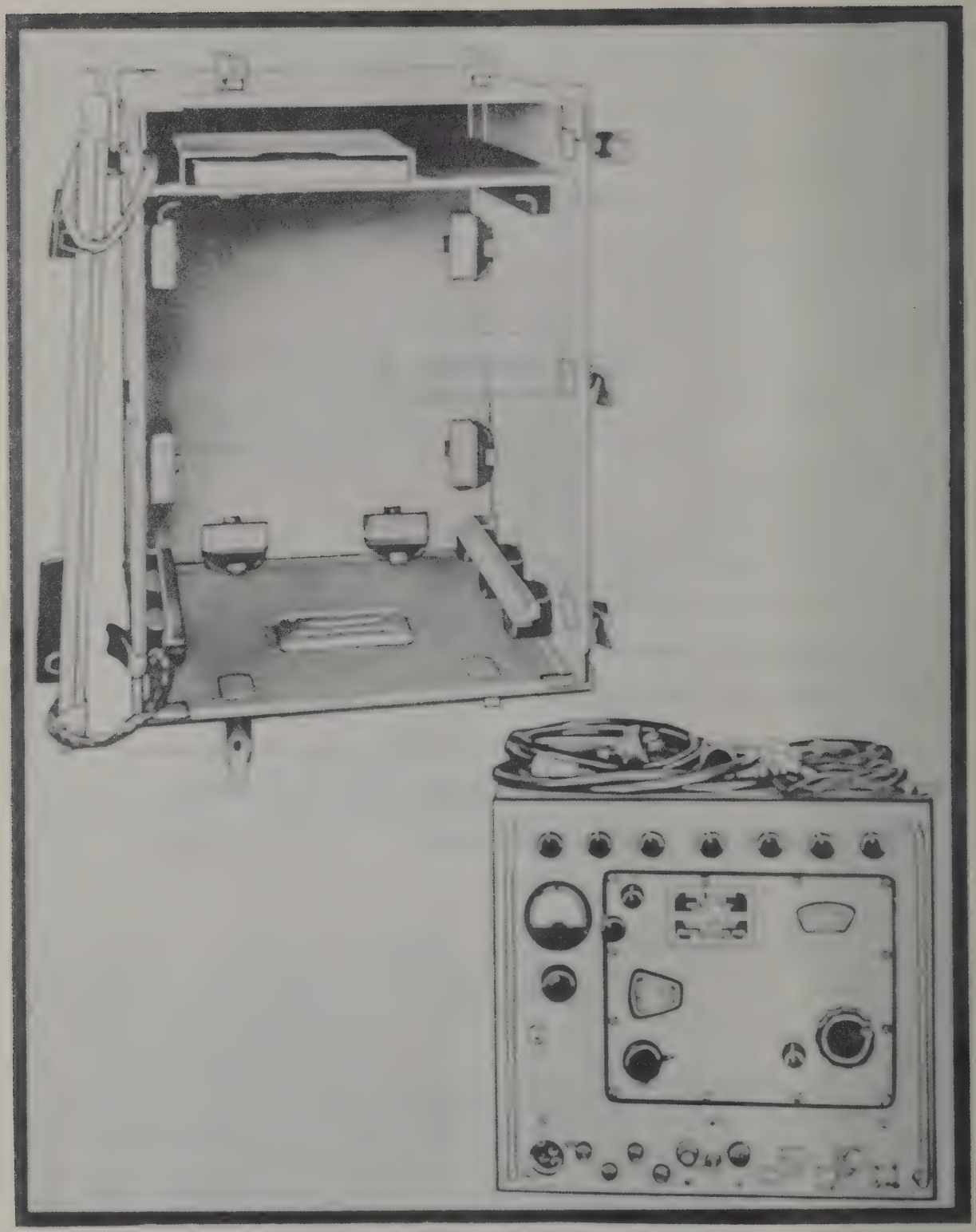


Figure 1–1. Radio Test Set AN/URM-44, Equipment Supplied

SECTION I

GENERAL DESCRIPTION

1-1. PURPOSE OF HANDBOOK.

1-2. The purpose of this handbook is to present information required for the operation and basic maintenance of Radio Test Set AN URM-44. Coverage is limited to complete information concerning the installation, operation, and that maintenance which may be performed by operating personnel. A description of the physical and electrical characteristics of the equipment, as well as a brief explanation of its theory of operation, are included in section I of this publication.

1–3. PURPOSE OF THE EQUIPMENT.

1–4. Radio Test Set AN URM-44 provides low-power radio-frequency test signals in the frequency range from 7000 to 10,750 megacycles per second, at a power level within the range from 10 to 127 db below one milliwatt (equivalent to a range from 70,000 microvolts to 0.1 microvolt when terminated in a 50-ohm load), for use in maintaining airborne and other electronic equipment. The equipment provides output test signals of the continuous-wave, pulse-modulated, or frequency-modulated type, which may be used to check the operation of radio and radar equipments, and to make laboratory measurements. The output frequency and power level of the test set are indicated on separate direct-reading dials located on the front panel.

1–5. GENERAL PHYSICAL CHARACTERISTICS.

(See figures 1–1 and 1–2.)

1–6. Radio Test Set AN URM-44 consists of Signal Generator TS-622/U, Transit Case CY-1192/URM-44, and accessory cables CX-337/U(6′) or CX-3135/U(6′), CG-92B/U(6′), and CG-409/U(8′). Signal Generator TS-622/U is supplied complete within its own metal instrument case. The entire unit fits into, and may be carried in, the aluminum-and-plywood construction Transit Case CY-1192/URM-44, which incorporates a compartment on its right-hand side for storing the accessory cables and instruction handbooks. The chassis of the signal generator is held within its equipment case by means of four cam-lock captive fasteners, located at the rear of the case. Handles are provided on the equipment front panel as a protection against damage to operating controls when the chassis is removed from the equipment case for servicing, and as a convenient means of carrying the equipment when the transit case is not in use.

1–7. All operating controls, receptacles, protective and spare fuses are located on the front panel and are clearly identified as to function or value by etched characters on the gray enamel finish front panel background. Also located on the front panel are the power monitoring meter, indicating dials and indicator lamps.

1–8. The overall dimensions and weight of the equipment are listed in table II. No provisions have been made for rack-mounting the signal generator when removed from its equipment case, since the metal case provides additional shielding to prevent spurious radiation and other "leakage" from the oscillator cavity within the chassis.

1–9. GENERAL ELECTRICAL CHARACTERISTICS.

(See figure 1–2.)

1–10. R-F SIGNAL GENERATOR. Signal Generator TS-622/U consists essentially of a velocity-modulated reflex klystron tube within a cavity oscillator, a bolometer bridge for r-f output measurement, a direct-reading calibrated attenuator dial and control for varying the test set power output, a direct-reading calibrated frequency dial and control for varying frequency output, associated r-f plumbing, and a modulator circuit. This modulator includes a sawtooth generator, which is used in producing the frequency-modulation output of the test set, and a pulse generator, which is used in producing the pulse-modulation output of the test set. Sawtooth or pulse modulation may be adjusted to a rate from 40 to 4000 pulses per second. When pulse modulation is used, pulse widths of 0.5 to 10 microseconds may be obtained. Regulated power supplies for producing the d-c voltages required by the oscillator, modulator, and bolometer bridge circuits are also included within the signal generator. The equipment's tube, fuse, and indicator lamp complement is given in paragraph 1–34, a technical summary of the equipment's electrical characteristics appears as paragraph 1–36.

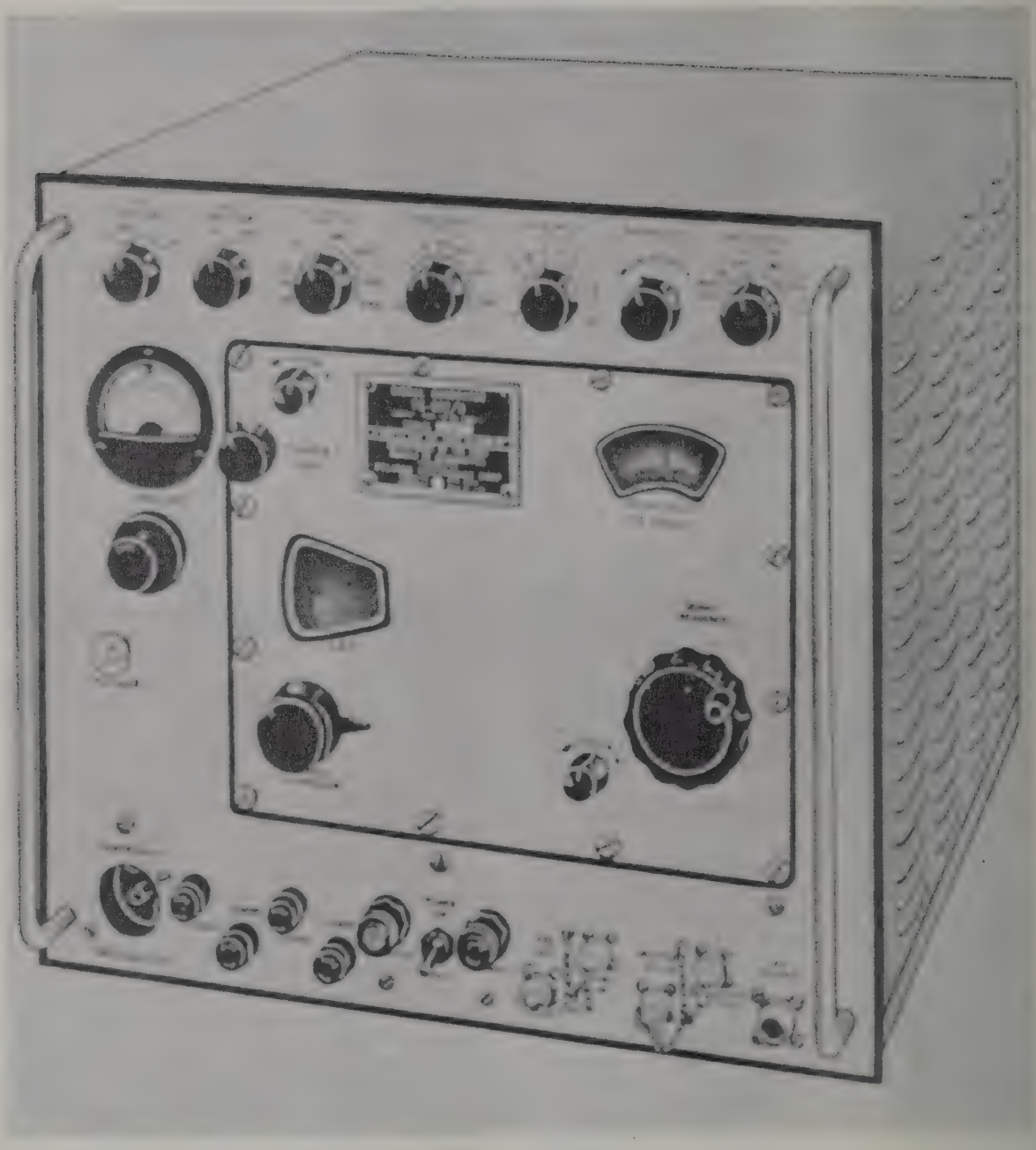


Figure 1–2. Signal Generator TS-622/U, within Equipment Case

1-11. SYNCHRONIZATION CIRCUITS.

1-12. Provision is made for synchronizing the signal generator with external equipments which produce either sine wave or pulse signals (positive or negative in polarity) of the characteristics described below.

TABLE I. EXTERNAL SYNC SIGNAL REQUIREMENTS

Characteristic	Sine wave sync	Pulse signal sync
Frequency range	40 to 4000 cps	40 to 4000 pps
Amplitude range	5 to 50 volts rms	5 to 50 volts peak
Pulse rise time	.....	0.1 to 1 usec
Pulse width	.....	0.5 to 5 usec

When externally synchronized, Signal Generator TS-622/U produces pulse-modulated or frequency-modulated r-f tests signals, as determined by the setting of the front panel MODULATION SELECTOR. This control, described functionally in section II of this handbook, selects the type of output desired from the modulator of the test set. When pulse output from the modulator is utilized, a video signal of positive polarity is applied to the control grid of the reflex klystron oscillator tube. Short bursts of r-f energy, having the same duration as each input video pulse, are produced and are available at the front panel RF OUTPUT receptacle for application to equipment under test. When sawtooth output from the modulator is utilized, a sweep signal is applied via an internal coaxial cable and coupling capacitor to the repeller electrode of the reflex klystron tube. Frequency-modulated r-f test signals, having a deviation from zero to at least plus and minus 3 megacycles, are then produced and are available at the RF OUTPUT receptacle. Both frequency deviation and sawtooth rate are adjustable by means of separate front panel controls. (*See figures 1-3 and 4-7.*)

1-13. INTERNAL PULSE GENERATING CIRCUITS.

1-14. Provision is made for operating the signal generator without the use of synchronizing signals from external equipment. With the front panel SYNC SELECTOR control set to its INT position, and with the MODULATION SELECTOR control also set to its INT position, a self-triggered, self-synchronized pulse generator is energized. Pulse-modulated r-f test signals are then produced, at a pulse repetition frequency adjustable between 40 and 4000 pulses per second, a pulse duration adjustable between 0.5 and 10 microseconds, and a delay (as measured between the leading edge of the pulse generator initiating trigger and the leading edge of the r-f test signal) adjustable between 3 and 300 microseconds at pulse repetition rates up to 2500 pulses per second. At repetition rates between 2500 and 4000 pulses per second, a delay not greater than 75% of the pulse period is obtainable. (Figure 2-2 is supplied to indicate the maximum pulse delay available at any setting of the pulse rate controls.) The internal sawtooth generator, which is used to produce the frequency-modulated r-f test signal, also may be used without synchronization to external equipment. With the front panel SYNC SELECTOR control set to its INT position, and with the MODULATION SELECTOR control set to its FM position, the self-synchronized, self-triggered sweep generator is energized. The magnitude of the sawtooth sweep signal is controlled by the test set FM AMPLITUDE potentiometer, the setting of which determines the r-f test signal frequency deviation. (*See figures 1-3 and 4-7.*)

1-15. EXTERNAL MODULATION CIRCUIT.

1-16. Provision is made for operating the signal generator with the internal modulator circuit inoperative, when an external pulse signal is desired as the source for pulse-modulation of the reflex klystron oscillator. Requirements of this external modulation signal are an amplitude of 15 to 70 volts positive or negative polarity, pulse width from 0.5 to 2500 microseconds, pulse spacing from 1.0 to 2500 microseconds, and pulse rise time and decay time from 0.1 to 1 microsecond. With the front panel MODULATION SELECTOR control set to its EXT POS position, positive polarity modulating signals are applied to the EXT MOD jack on the test set front panel, are increased in magnitude by passing through a one-stage amplifier, and are then coupled to the pulse amplifier and keyer circuit before modulating the oscillator output. With the front panel MODULATION SELECTOR control set to its EXT NEG position, negative polarity modulating signals are applied to the EXT MOD jack, are increased in magnitude by passing through a two-stage inverter and amplifier, and are then coupled to the pulse amplifier and keyer circuit before modulating the reflex klystron oscillator. The

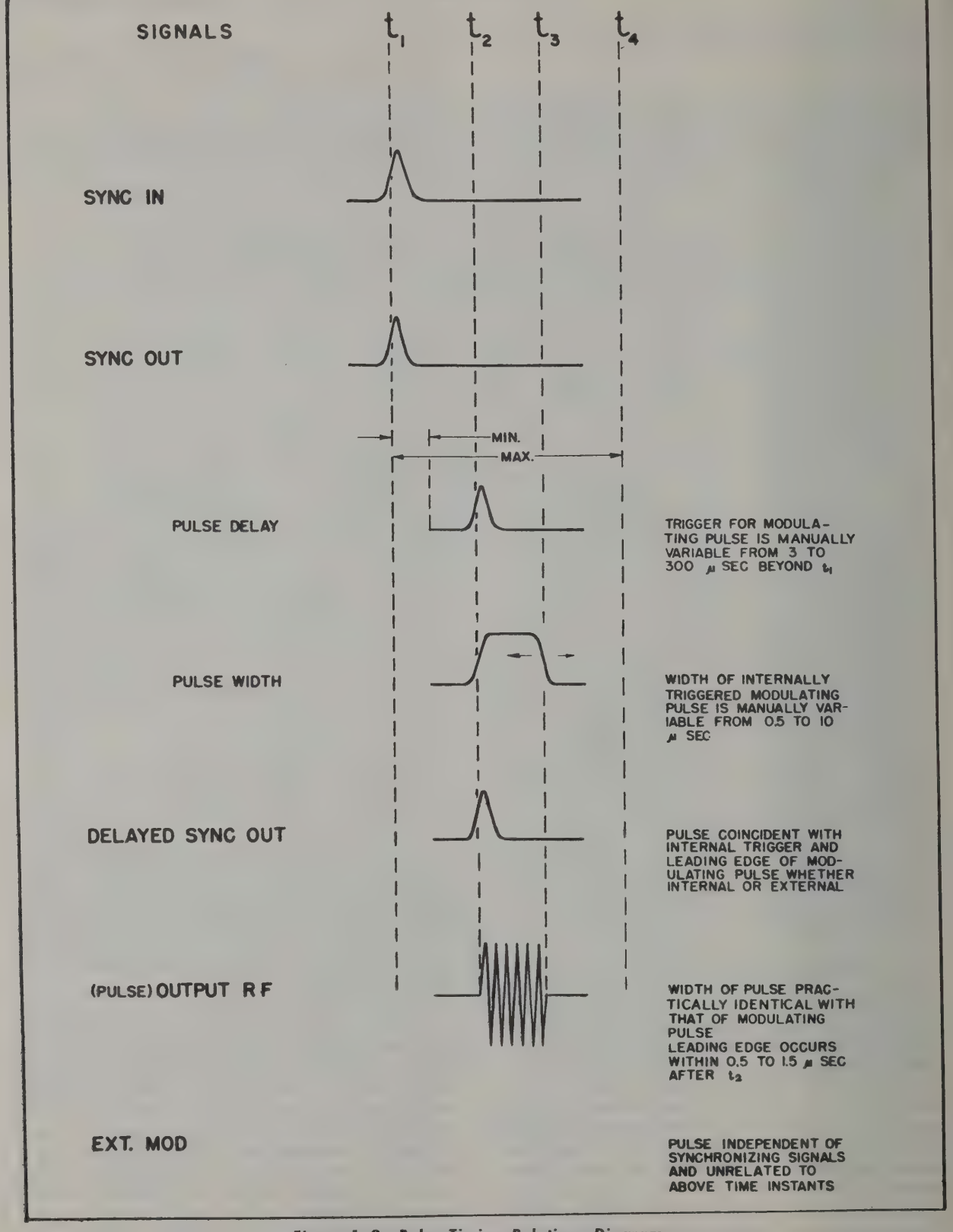


Figure 1–3. Pulse Timing Relations Diagram

signal generator produces pulse-modulated r-f test signals, at a pulse repetition rate and pulse duration dependent on the applied external modulating signal, in this type of operation.

1-17. POWER MONITORING CIRCUIT.

1-18. A portion of the continuous-wave, frequency-modulated, or pulse-modulated output from the klystron oscillator is fed to a self-contained power monitor bridge. With the METER SELECTOR switch, located on the signal generator chassis, set to its POWER MONITOR position, an indication of r-f power output, relative to one milliwatt, can be obtained. With the pointer of the POWER SET meter deflected to its zero db calibration mark, r-f output level is read directly from the OUTPUT ATTENUATOR dial setting. With the meter pointer deflected to the right or left of the zero db calibration mark, r-f output level is obtained by adding the dbm value shown by the *deflection of the meter pointer* to the dbm value shown under the *crossed hairlines of the* OUTPUT ATTENUATOR *dial.*

1-19. OUTPUT SYNC SIGNALS AVAILABLE.

1-20. Two output sync signal jacks are provided on the front panel of the signal generator as a means of connecting a trigger signal to external equipment under measurement. One of these jacks, located above and to the left of the RF OUTPUT receptacle, is designated UNDELAYED SYNC. It delivers a positive output pulse of approximately one microsecond width, occurring coincident with *either* the leading edge of the external sync input signal (when used), *or* the leading edge of the internally generated trigger (when pulse output of the modulator circuit is used). The second jack, labeled DELAYED SYNC, delivers a positive output pulse of approximately one microsecond width, occurring almost coincident with the leading edge of the r-f test signal produced by the reflex klystron oscillator. The delay of both the DELAYED SYNC output pulse and the r-f test signal is variable, with respect to the SYNC IN pulse or the internal trigger pulse (whichever is in use), by means of the PULSE DELAY control. A delay of between 3 and 300 microseconds can be obtained by setting the control to the desired panel calibration mark.

1-21. OSCILLATOR AND ATTENUATOR CIRCUITS.

1-22. The frequency of the r-f oscillator is variable between 7000 and 10,750 megacycles. This frequency is controlled from the front panel of the signal generator by adjustment of the SIGNAL FREQUENCY control, which drives the reflex klystron tuning mechanism and calibrated dial. Oscillator output is applied from a type N connector, labeled RF OUTPUT, to the equipment under test via the coaxial r-f cable supplied, designated CG-92B/U (6'). The power level of the oscillator output can be varied from 10 to 127 decibels below one milliwatt by rotation of the OUTPUT ATTENUATOR control, which drives the r-f coupling mechanism and DBM calibrated dial. The level of the test signal output at RF OUTPUT receptacle J13 may be read from the attenuator dial, directly behind the crossed hairline setting, as long as the pointer of the POWER SET meter is at the red line calibration mark (zero db indication). (*See section III of this handbook for the procedure used to position the meter pointer to its zero db mark, when initially placing the equipment into operation.*)

1-23. POWER SUPPLY CIRCUITS.

(*See figure 4-7.*)

1-24. The signal generator has four interconnected rectifier and voltage-regulated circuits. Immediately after throwing the POWER switch to its ON position, the positive 250-volt supply applies positive potentials of 108 volts dc, for use by tubes V3 and V8 in the modulator; 175 volts dc, for use by tube V9 in the modulator; and 450 volts dc, for use by the 400-cycle multivibrator tubes V32, V33, on the main chassis. After a 60-second delay cycle, this power supply applies its regulated 250-volt positive potential to the plates of modulator tubes V1 through V9, and to the r-f power monitor bridge circuit tubes V38, V39. This 250-volt positive power supply consists of tubes V34 through V37.

1-25. The second power supply circuit, designated "beam supply," consists of the voltage-doubler power supply, employing tubes V24 through V31. After the 60-second delay cycle, the voltage doubler circuit develops a negative 1250-volt output, which is applied to pulse amplifier tube V10, keyer tube V11, and klystron tube V13 cathode. The voltage doubler circuit also develops a negative 87-volt output, which is applied as bias potential in the modulator, and as a reference voltage for the positive 250-volt supply.

1-26. The third circuit, designated "keyer supply," consists of tubes V14 through V18. Its output is also delayed for 60 seconds after the initial application of power. The negative 1100-volt output of the keyer supply is employed as plate potential by pulse amplifier tube V10 and keyer tube V11; its negative 1358-volt output is utilized as cathode potential by the same keyer circuitry, tubes V10 and V11.

1-27. The fourth and final power supply, designated "repeller supply," consists of tubes V19 through V22, whose output is also delayed for 60 seconds after the initial application of power, so that the klystron heater is fully energized before the application of repeller voltage. The negative 1250-volt output of the keyer supply is referenced to the repeller supply. The repeller output voltage is 1700 volts negative, with respect to chassis ground, and is applied to the repeller tracking circuit, consisting of variable resistors R91 through R96, located in the keyer chassis.

1–28. EQUIPMENT SUPPLIED.

1–29. The complete Radio Test Set AN/URM-44 equipment supplied by the manufacturer is listed in the table below, and is illustrated in figure 1–1. A complete table of replaceable parts appears in the Illustrated Parts Breakdown handbook.

TABLE II. EQUIPMENT SUPPLIED

Qty per Equip	*Name of Unit*	*Type Designation*	*Overall Dimensions*			*Volume*	*Weight*
			Height	*Width*	*Depth*		
1	RF Signal Generator	TS-622/U	15	17¼	19½	4900	100
1	Transit Case	CY-1192/URM-44	22½	18	23¼	9400	33
1	Power Cable	CX-337/U(6′) or CX-3135/U(6′)	.....	.....	72	.....	0.62
1	RF Cable	CG-92B/U(6′)	.....	.....	72	.....	1
2	Video Cord	CG-409/U(8′)	.....	.....	96	.....	0.25 each

Unless otherwise stated, dimensions are in inches, volume is in cubic inches, weight is in pounds.

1–30. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1–31. Radio Test Set AN/URM-44 is supplied complete and ready for operation. The only additional requirement is a power source of nominal 115-volt output, within the frequency range from 50 to 1000 cycles per second, single phase.

1–32. POWER SOURCE REQUIREMENTS.

1–33. Signal Generator TS-622/U operates from a 115-volt, 50 to 1000 cycle per second power source, single phase, and has a power consumption of approximately 400 watts. The voltage-regulated power supplies within the signal generator enable the equipment to operate without change of calibration with line-voltage variations from 103.5 to 126.5 volts ac.

1–34. ELECTRON TUBE, FUSE, AND INDICATOR LAMP COMPLEMENT.

1–35. Table III, below, lists in numerical order the types and ratings of the entire complement of electron tubes, fuses, and indicator lamps used in the equipment.

TABLE III. EQUIPMENT ELECTRON TUBE, FUSES, AND INDICATOR LAMP COMPLEMENT

Application	*Type Designation*	*Used in keyer and r-f box*	*Used in main chassis*	*Used in modulator*	*Total per equipment*
Electron Tubes					
Miniature voltage regulator	OB2WA	.....	2	.....	2
Full-Wave high-vacuum rectifier, ruggedized	5R4WGA	.....	4	.....	4
Miniature power amplifier pentode, receiving	6AK6WA	.....	1	2	3
High current low mu twin triode	6AS7G or 6080WA	.....	1	.....	1
Miniature r-f pentode, sharp cutoff	6AU6WA	1	4	.....	5
Full-wave high-vacuum rectifier, ruggedized	6X4W	1	1	.....	2
Twin triode	12AT7WA	1	5	7	13
Transmitter beam power amplifier	*807/5933	.....	3 or 1†	.....	3 or 1†
Miniature voltage reference tube	5651	.....	5	.....	5
Reflex klystron, requiring external cavity	*5721/6390	1	.....	.....	1
Totals		4	26	9	39
Indicator Lamps					
Heater and power pilot lamps	47	.....	2	.....	2
Dial lamps	47	2	.....	.....	2
Blower pilot lamp	NE51	.....	1	.....	1
Fuses					
Operating fuses; 5 ampere rating	MTH5	.....	2	.....	2
Spare fuses; 5 ampere rating	MTH5	.....	2	.....	2

*For replacement use tube type 5933 and 6390 †One tube required if modified by FSN R5800K-URM44-CHI

1–36. TECHNICAL SUMMARY.

a. Nomenclature.....Radio Test Set AN/URM-44

b. Contract number..NOas 51-1179, N383-30863A, N383-30847A, N383-46411A

c. Contractor..Polarad Electronics Corporation, Long Island City 1, New York

d. Cognizant Naval Inspector.....Inspector of Naval Material, USN, New York, N. Y.

e. Frequency range.....7000 to 10,750 megacycles continuous tuning in one band. Tuning dial calibrated at 50 megacycle intervals to within ±1% of actual frequency.

f. Type of emission....C-w, a-m (pulse-modulated), or f-m.

g. Power range.....Continuously adjustable within the range from 10 to 127 db below one milliwatt across a 52-ohm resistive load for c-w operation; within ±1 decibel of this range for pulse operation.

h. Modulation capability.....Pulse modulation from the self-contained pulse generator, or from an external modulation source; frequency-modulation from the self-contained sawtooth generator, as described below:

(1) From the self-contained pulse generator.

(a) Adjustable repetition rate from 40 to 4000 pulses per second.

(b) Adjustable pulse width from 0.5 to 10 microseconds, measured between points on initial rise and decay which are 50% of the largest amplitude of the initial rise.

(c) Pulse rise time less than 0.5 microsecond, as measured from 10% to 90% of full amplitude.

(d) Pulse decay time less than 0.5 microsecond, as measured from 90% to 10% of full amplitude.

(e) Delay between the leading edge of undelayed trigger pulse (*either* internally generated *or* derived from externally applied sync signal) and the leading edge of the pulse-modulated r-f test signal adjustable between 3 and 300 microseconds, but not greater than 75% of the pulse period. (See figure 2-2 for pulse delay time obtainable at any setting of the pulse rate controls.)

(2) From an external source, supplying the modulating signal.

(a) Required pulse amplitude between 15 and 70 volts, of positive or negative polarity.

(b) Required pulse width between 0.5 and 2500 microseconds.

(c) Required pulse spacing between 1 and 2500 microseconds.

(d) Required pulse rise and decay times between 0.1 and 1 microsecond, as measured between 10% and 90% of full amplitude.

(3) From the self-contained sawtooth (f-m) generator.

(a) Sweep rate adjustable from 40 to 4000 sweeps per second.

(b) Deviation adjustable from zero to at least plus and minus 3 megacycles.

(c) Power output of f-m test signal adjustable from minus 10 to minus 127 db. Maximum change in power output during a deviation up to 3 megacycles is less than 3 db.

i. External sync sources Either sine-wave or pulse-type source, as described below:

(1) Sine wave sync.

(a) Required frequency between 40 and 4000 cycles per second.

(b) Required amplitude between 5 and 50 volts rms.

(2) Pulse signal sync.

(a) Required repetition rate between 40 and 4000 pulses per second.

(b) Required amplitude between 5 and 50 volts peak, of positive or negative polarity.

(c) Required pulse rise time between 0.1 and 1 microsecond.

(d) Required pulse width between 0.5 and 5 microseconds.

Sync output signals available from test set.

Both undelayed and delayed video output sync signals available. Delay is measured from the leading edge of the modulator trigger pulse (*either* internally generated *or* synchronized with an externally applied sync input signal) to the leading edge of the r-f test signal as described below:

1–36. TECHNICAL SUMMARY. (Continued)

(1) Undelayed sync output.

(a) Positive polarity, between 25 and 100 volts pulse amplitude.

(b) Pulse width between 0.5 and 5 microseconds.

(c) Pulse rate between 40 and 4000 pulses per second, identical with rate of pulse-modulated r-f test signal.

(d) Pulse rise and decay times less than 1 microsecond.

(e) Required load: 500 to 100,000 ohms resistance, shunted by a maximum of 500 micromicrofarads capacitance.

(2) Delayed sync output.

(a) Positive polarity, between 25 and 100 volts pulse amplitude.

(b) Pulse width between 0.5 and 5 microseconds.

(c) Pulse rate between 40 and 4000 pulses per second, identical with rate of pulse-modulated r-f test signal.

(d) Pulse rise and decay times less than 1 microsecond.

(e) Required load: 500 to 100,000 ohms resistance, shunted by a maximum of 500 micromicrofarads capacitance.

(f) Timing with respect to pulse-modulated r-f test signal: Occurring at approximately same instant as leading edge of r-f test signal.

k. Output impedance at RF OUTPUT receptacle..... 52 ohms. Standing wave ratio less than 6 db, looking backward into inoperative Signal Generator TS-622 U.

l. Power requirements.. 103.5 to 126.5 volts, 50 to 1000 cycles per second, single phase, ac.

m. Power consumption of equipment..... Approximately 400 watts at a power factor of approximately 85%

NOTE

In equipments manufactured under Contract N383-46411A, Power Cable Assembly CX-337/U (6′), which has a two-prong male connector at one end, and a two-socket female connector at the other end, has been replaced by Power Cable Assembly CX-3135/U (6′). The latter has a three-prong, grounding-type male connector at one end, and a three-socket female connector at the other end. In the same equipments, the front panel POWER INPUT receptacle J14 is male, three-prong, to mate with the three-socket female connector of Power Cable Assembly CX-3135/U (6′). Where text reference is made to the former Power Cable Assembly CX-337/U (6′), use Power Cable Assembly CX-3135/U (6′).

SECTION II

OPERATING PROCEDURES

2-1. GENERAL.

2-2. The complete step-by-step procedures for obtaining each of the types of output available from the signal generator are given in paragraphs 2-9 through 2-18, below. In addition, the procedures for obtaining auxiliary video outputs for use in triggering external equipments, and for space heater operation are given in paragraphs 2-19 through 2-24. The controls and connectors referred to in the operating procedures are shown in figure 2-1; their functions are listed in table IV.

2-3. CALIBRATION ADJUSTMENT.

2-4. To assure satisfactory operation and correct results, it is mandatory that the pre-operation check and adjustment procedures outlined in section III (paragraph 3-3) be followed prior to each use of the equipment.

2-5. OPERATION.

2-6. SELECTING TYPE OF OPERATION. Three basic types of operation, c-w, pulse-modulation, or frequency-modulation, are obtainable from Signal Generator TS-622/U, dependent on front panel control settings. The tests to be performed on the equipment under measurement will determine the type of signal generator operation employed.

2-7. POWER CONNECTION.

2-8. Apply operating power to the equipment as directed below:

a. Connect nominal 115-volt 50 to 1000 cps power source to POWER INPUT receptacle via cable W401. Set POWER ON-OFF switch to ON, and MODULATION SELECTOR to CW position.

b. Allow at least 20 minute warm-up period, or longer where ambient temperature is below approximately 10 degrees C (50 degrees F).

2-9. TO OBTAIN CW OUTPUT TEST SIGNALS.

2-10. To obtain continuous-wave output test signals, proceed as directed below:

a. Set SIGNAL FREQUENCY dial to desired frequency, within the range 7000 to 10,750 mc, and lock control knob in desired position.

b. Connect 50-ohm resistive external load to RF OUTPUT jack via r-f transmission line W404.

c. Rotate MODULATION SELECTOR to ZERO SET position. Adjust ZERO SET coarse and FINE concentric knobs until POWER SET meter pointer deflects to ZERO SET (index line at extreme left end of meter scale arc).

d. Rotate MODULATION SELECTOR to CW position.

e. Set OUTPUT ATTENUATOR dial to desired value of r-f signal level, within the range from 10 to 127 dbm, and lock control knob.

f. Adjust POWER SET control until POWER SET meter pointer deflects to red line 0 DB calibration mark. Power output level may then be read directly from calibrated OUTPUT ATTENUATOR dial.

Note

If meter pointer cannot be deflected to red line calibration mark by rotation of POWER SET control, actual level of r-f test signal at RF OUTPUT jack can be obtained by adding meter pointer indication to OUTPUT ATTENUATOR dial indication algebraically.

2-11. TO OBTAIN PULSED RF OUTPUT TEST SIGNALS, USING FREE-RUNNING PULSE MODULATOR.

2-12. Pulse-modulated output from the signal generator can be obtained with or without synchronization with external equipment. Proceed as directed below, when use of the self-contained free-running multivibrator, in the modulator circuit, is desired:

a. After completing step 2-10, above, rotate MODULATION SELECTOR to INT position.

b. Rotate SYNC SELECTOR to INT.

c. Set RATE MULTIPLIER to X1 position for pulse rate from 40 to 400 pulses per second, or to X10 position for pulse rate from 400 to 4000 pulses per second. Adjust PULSE RATE control to desired repetition rate.

d. Adjust PULSE WIDTH control for desired pulse width between 0.5 and 10 microseconds.

e. Adjust PULSE DELAY control as desired, for delay from 3 to 300 microseconds with respect to modulator trigger, but not greater than 75% of pulse period. (See Figure 2-2.)

2-13. TO SYNCHRONIZE THE MODULATOR WITH AN EXTERNAL VOLTAGE.

2-14. To synchronize the operation of Signal Generator TS-622/U with an external equipment, perform the following operational steps:

a. After completing step 2-10, above, rotate MODULATION SELECTOR to INT position.

b. Connect the external synchronizing voltage to SYNC IN jack via video cord W402.

c. Set SYNC SELECTOR to the SIN, —, or + position, to correspond with the type of external sync voltage to be used.

d. Set RATE MULTIPLIER and PULSE RATE controls to the approximate pulse repetition rate of applied sync voltage.

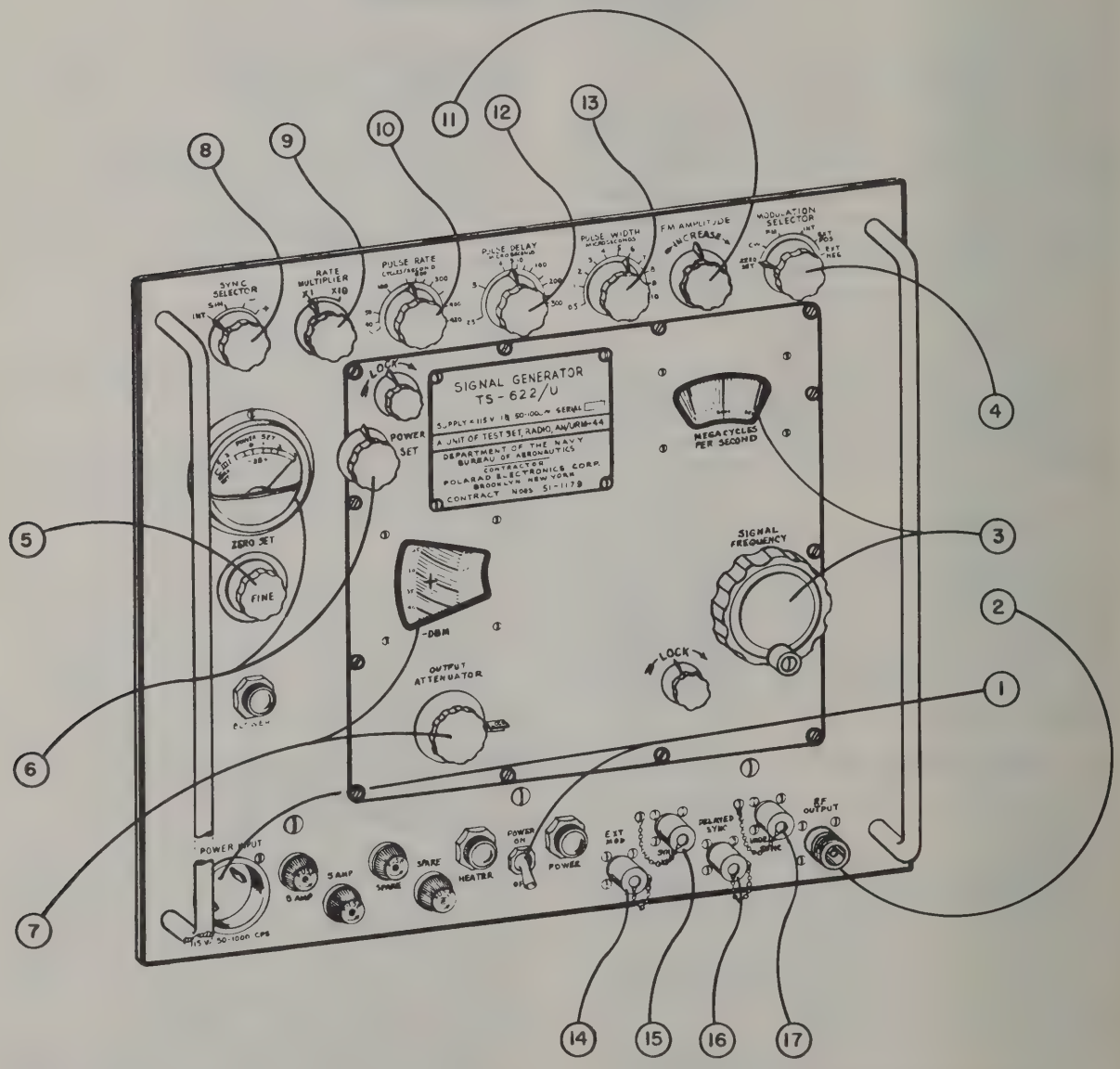


Figure 2–1. Signal Generator TS-622/U, Operating Controls and Connectors

e. Adjust PULSE WIDTH control for the desired r-f pulse width, between 0.5 and 10 microseconds.

f. Adjust PULSE DELAY control as desired, to produce a delay from 3 to 300 microseconds with respect to leading edge of applied sync signal, but not greater than 75% of the pulse period.

2-15. TO MODULATE THE OSCILLATOR WITH AN EXTERNAL VOLTAGE.

2-16. To apply an external modulating signal source to the reflex klystron oscillator of Signal Generator TS-622/U, perform the following operations:

a. Connect the external pulse or square wave voltage to the EXT MOD jack via video cord W403. The modulating voltage must have the characteristics described in paragraph 1-15 of this publication.

b. After completing step 2-10, above, rotate MODULATION SELECTOR to EXT POS or EXT NEG position, corresponding with the polarity of the applied external modulating voltage.

2-17. TO OBTAIN FREQUENCY-MODULATED OUTPUT TEST SIGNALS.

2-18. Frequency-modulated output from the signal generator may be synchronized either internally, or from an external equipment. To use either type of sync voltage, proceed as follows:

a. After completing step 2-12 or 2-14, above, rotate MODULATION SELECTOR to FM position.

b. Adjust FM AMPLITUDE control for the desired amount of deviation, adjustable from zero to at least plus and minus 3 mc.

2-19. TO OBTAIN A TRIGGER FOR EXTERNAL USE.

2-20. Two trigger voltages for external use are available, both when the modulator is free-running and when synchronized with an external voltage. They are:

a. A positive undelayed trigger is obtainable from the UNDELAYED SYNC jack.

b. A positive delayed trigger is obtainable from the DELAYED SYNC jack. This pulse is essentially synchronous with the r-f pulse.

2-21. HEATER OPERATION.

2-22. To shut the instrument off while in any operating sequence, set POWER ON-OFF switch to its OFF position. This action disconnects the a-c power from the power source and leaves only the space heaters connected and in operation. In humid climates, heater operation is desirable when the instrument is idle, to prevent excessive moisture condensation.

2-23. REMOVING POWER FROM THE EQUIPMENT.

2-24. To remove operating power from the equipment completely, disconnect female connector P401, terminating power cable W401, from the front panel POWER INPUT receptacle.

2–25. OPERATING CONTROLS AND CONNECTORS.

2–26. Table IV, below, lists the panel designation, normal sequence of operation and the function of all operating controls and connectors located on the front panel of the signal generator. At all times, operating personnel must take care to avoid disturbing the locked adjustments on calibrated sub-assemblies. Should recalibration of any of the controls be indicated, or should replacement of the r-f reflex klystron oscillator tube V13 be required, Overhaul and Repair Department personnel (of the Navy) or Depot personnel (of the Air Force) are directed to the detailed step-by-step procedures located in the Handbook of Overhaul Instructions for this equipment.

TABLE IV. OPERATING CONTROLS AND CONNECTORS.

Panel Designation	*Sequence of Operation*	*Function*
POWER INPUT RECEPTACLE and POWER ON-OFF switch	1	POWER INPUT receptacle connects test set to 115-volt, 50 to 1000 cps, source via power cable CX-337/U(6'). Operating power is applied to test set space heaters and to HEATER indicating lamp, with POWER switch in OFF position. POWER ON-OFF switch applies nominal 115-volt a-c power to power transformers, time delay relay, and POWER ON indicating lamp, with POWER switch in ON position. Equipment space heaters are disconnected from power source in ON position of switch.
RF OUTPUT receptacle	2	Connects the r-f test signal (c-w, f-m, or pulse modulated, as desired) via r-f cable CG-92B/U(6') to the equipment under measurement, when MODULATION SELECTOR is set to any position other than ZERO SET.
SIGNAL FREQUENCY control and dial	3	Rotation of the control drives the reflex klystron oscillator tuning mechanism and dial to set the signal generator operating frequency. The dial is directly calibrated in frequency at 50-megacycle intervals.
MODULATION SELECTOR	4	This switch is rotated to its ZERO SET position to make the r-f oscillator circuit inoperative, for the initial calibration procedure. After zero-setting the power level meter, through adjustment of ZERO SET controls (as directed below), the switch permits selection of c-w, f-m, or pulse modulation output, as desired. For pulse operation, the switch permits selection of the internal pulse generator, an external positive modulating signal or an external negative modulating signal as the source for the r-f oscillator pulse modulation.
ZERO SET FINE and coarse controls	5	With MODULATION SELECTOR in its ZERO SET position, these concentric shaft potentiometers permit calibration of the internal power monitor bridge circuit, as indicated by deflection of the meter pointer to its ZERO SET position.
POWER SET control	6	With MODULATION SELECTOR in its CW position, this control permits adjustment of the amount of r-f current flowing through the power monitor bridge. When the meter pointer deflects to the zero db mark, by adjustment of this control, the power level of signals at the RF OUTPUT jack can be read directly from the calibrated OUTPUT ATTENUATOR dial. If the meter pointer cannot be deflected to the zero db mark by adjustment of this control, the power monitor meter indication must be added algebraically to the calibrated OUTPUT ATTENUATOR dial indication.
OUTPUT ATTENUATOR control and dial	7	This control mechanically drives the r-f output attenuator and dial, to control the test set r-f output power. The dial is directly calibrated in decibels below one milliwatt across 52 ohms, resistive load, at the front panel RF OUTPUT receptacle.
SYNC SELECTOR	8	This four-position switch is used to select the type of synchronizing signal (when used) applied to the self-contained modulator circuit. *a.* In its INT position, the modulator develops pulse or sawtooth output, as determined by the setting of the MODULATION SELECTOR, without synchronization with external equipments.

TABLE IV. OPERATING CONTROLS AND CONNECTORS. (Continued)

Panel Designation	*Sequence of Operation*	*Function*
SYNC SELECTOR (Cont.)	8	*b.* In its SIN position, the internal pulse or sawtooth generator is synchronized with a sine wave sync signal from external equipment, with the signal applied to the front panel SYNC IN jack. *c.* In its − position, the internal pulse or sawtooth generator is synchronized with negative polarity video pulses from external equipment, with the signal applied to the front panel SYNC IN jack. *d.* In its + position, the internal pulse or sawtooth generator is synchronized with positive polarity video pulses from external equipment, with the signal applied to the front panel SYNC IN jack.
RATE MULTIPLIER switch	9	This two-position switch is used to select the range of pulse repetition rate (with MODULATION SELECTOR in its INT position), and the range of sweep rate (with MODULATION SELECTOR in its FM position). In the X1 position of the RATE MULTIPLIER switch, a range of 40 to 400 pulses or sawtooth sweeps per second is available; in the X10 position, a range of 400 to 4000 pulses or sawtooth sweeps per second is available.
PULSE RATE control	10	This dual-potentiometer control is used to select the pulse repetition rate of the modulator, when MODULATION SELECTOR is in its INT position; the control is also used to select the sawtooth sweep rate when MODULATION SELECTOR is in is FM position. The rate is read directly from the calibrated panel markings when RATE MULTIPLIER is in its X1 position; pulse rate is ten times the calibrated panel markings, when the RATE MULTIPLIER is in its X10 position.
FM AMPLITUDE control	11	This control is operative *only* when MODULATION SELECTOR is set to its FM position. The control sets the magnitude of sawtooth signal applied to the repeller of the reflex klystron oscillator. The range of frequency deviation available from this control is from zero deviation (extreme counterclockwise setting) to at least plus and minus 3 Mc.
PULSE DELAY control	12	This control is operative when MODULATION SELECTOR is set to its INT (internal pulse-modulation) or FM (frequency-modulation) position. The control permits adjustment of the delay between the leading edge of the undelayed sync pulse and the leading edge of the r-f output test signal over the range from 3 to 300 microseconds, but not greater than 75% of the pulse period, as shown in figure 2–2.
PULSE WIDTH control	13	This control is operative *only* when MODULATION SELECTOR is set to its INT (internal pulse-modulation) position. The control permits adjustment, from 0.5 to 10 microseconds, of the pulse width of the r-f test signal. This width is measured between points on the initial rise and decay which are 50% of the peak amplitude of the initial rise.
EXT MOD jack	14	This jack is utilized *only* when MODULATION SELECTOR is set to its EXT POS or EXT NEG position. The jack connects the test set, via video cord CG-409/U(8'), to a source of external modulating voltage, of positive or negative polarity. The setting of the MODULATION SELECTOR must correspond with the polarity of the applied external modulating signal.

TABLE IV. OPERATING CONTROLS AND CONNECTORS. (Continued)

Panel Designation	*Sequence of Operation*	*Function*
SYNC IN jack	15	This jack is utilized when it is desired to synchronize signal generator TS-622/U with external equipment. MODULATION SELECTOR is placed in its FM or INT position, to produce frequency-modulated or pulse-modulated output, as desired. The jack connects the test set, via video cord CG-409/U(8′), to a sine wave or pulse sync signal. SYNC SELECTOR must be rotated to that panel designation which corresponds with the type of sync signal applied.
DELAYED SYNC jack	16	This jack is utilized when MODULATION SELECTOR is in its FM or INT position, and it is desired to trigger external equipment under measurement with the positive video pulse output from the signal generator. This pulse output, delayed from 3 to 300 microseconds (up to 75% of the pulse period) from the leading edge of the undelayed synchronizing signal, is fed to the external equipment via video cord CG-409/U(8′).
UNDELAYED SYNC jack	17	This jack is utilized when MODULATION SELECTOR is in its FM or INT position, and it is desired to trigger external equipment under measurement with the positive video pulse output from the signal generator, undelayed with respect to the leading edge of the modulator trigger pulse.This output is fed to the external equipment via video cord CG-409/U(8′).

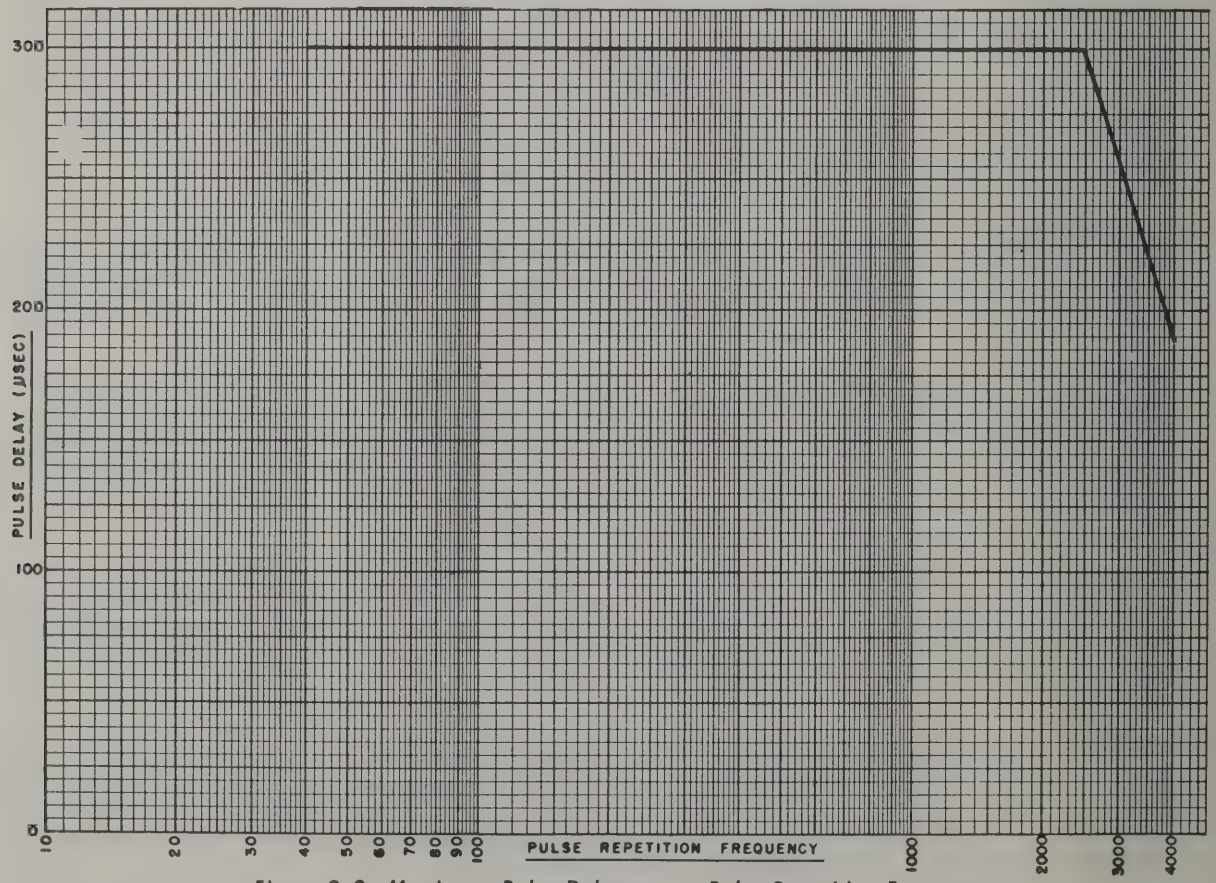


Figure 2–2. Maximum Pulse Delay versus Pulse Repetition Frequency

SECTION III

OPERATING CHECKS AND ADJUSTMENTS

3–1. PREPARATION FOR USE.

3–2. Radio Test Set AN/URM-44 is complete in one portable unit and is ready for use upon delivery. No permanent or special installation procedures are necessary. Upon delivery, the test set should be checked, however, to make certain that no damage has occurred during shipment. To prepare the test set for operation, proceed as follows:

a. Unlatch the ten hooks from the cover of the transit case and lift the cover from the top of the case. The cover is secured to the case by chains.

b. Grasp the signal generator by its two handles on its front panel and remove the equipment from the transit case. Place the signal generator on a work bench in any convenient position adjacent to the equipment to be tested, but outside of any direct, strong r-f field.

c. Remove power cord CX-337/U(6′) from the stowage compartment of the transit case. Insert the female connector of the power cord into the POWER INPUT receptacle in the lower left-hand corner of the test set front panel, and connect the male connector to a 115-volt, 50- to 1000-cycle per second, single phase power source. With the POWER switch in its OFF position, the front panel indicator lamp designated HEATER will be illuminated, indicating that the equipment space heaters are in operation. If the equipment has been subjected to excessive humidity, the space heaters should be left on as long as practicable, in order to dry out condensed moisture.

3–3. PRE-OPERATING CHECK AND ADJUSTMENT.

3–4. To ascertain that the equipment is in operating condition, make the following checks:

a. Throw the POWER switch to the ON position. The HEATER panel lamp should now be extinguished, indicating that the equipment space heaters are now disconnected from the power source. The front panel POWER lamp should light.

b. Allow the test set to warm up for at least one minute, so that the self-contained time delay relay can complete its cycle. This relay prevents the application of high voltage to the keyer and oscillator tubes until their tube heaters have been energized for a full minute. During this delay period, the BLOWER panel lamp should light, and operation of the blower motor should be audible. Since the blower ventilates the reflex klystron oscillator tube, it is important to check carefully that the blower motor is operating. Any fault in the blower motor circuit requires immediate trouble-shooting, as outlined in the Handbook of Overhaul Instructions for this equipment.

c. Connect the load to the RF OUTPUT receptacle, in the lower right-hand corner of the test set front panel, via r-f cable CG-92B/U, which is stored in the transit case accessory compartment.

3–5. To calibrate the signal generator output level, proceed as directed in figure 3–1 and the directions below:

a. Allow the test set to warm up for at least 20 minutes, with the POWER switch in its ON position, and MODULATION SELECTOR in its CW position.

b. *Step 2 of figure 3–1.* Adjust the SIGNAL FREQUENCY control until the dial shows the desired operating frequency.

c. *Step 3 of figure 3–1.* Check that the equipment under measurement is coupled to the RF OUTPUT receptacle.

d. *Step 4 of figure 3–1.* Turn the MODULATION SELECTOR to the ZERO SET position.

e. *Step 5 of figure 3–1.* Adjust the ZERO SET coarse (outer knob) and FINE controls carefully until the pointer of the power monitor meter deflects to the left-hand index of the scale, designated ZERO SET.

f. *Step 6 of figure 3–1.* Turn the MODULATION SELECTOR to the CW position.

g. *Step 7 of figure 3–1.* Set the OUTPUT ATTENUATOR control to the desired value of r-f signal level, as shown under the crossed hairlines of the calibrated attenuator dial. This output level is expressed in decibels below one milliwatt, working into a resistive load of 52 ohms.

h. *Step 8 of figure 3–1.* Adjust the POWER SET control until the pointer of the power monitor meter deflects to the red line calibration mark, indicating that the r-f power output level may be read directly from the attenuator dial setting. If the meter pointer cannot be deflected to the zero db calibration mark, the actual level of the r-f test sgnal at the RF OUTPUT receptacle can be determined by adding the meter pointer indication to the attenuator dial indication. For example, if the meter pointer remains deflected to the plus 1 db mark after adjusting the POWER SET control, and the output attenuator dial indication is minus 54 dbm, the correct output level of the test signal at the RF OUTPUT receptacle is minus 53 dbm.

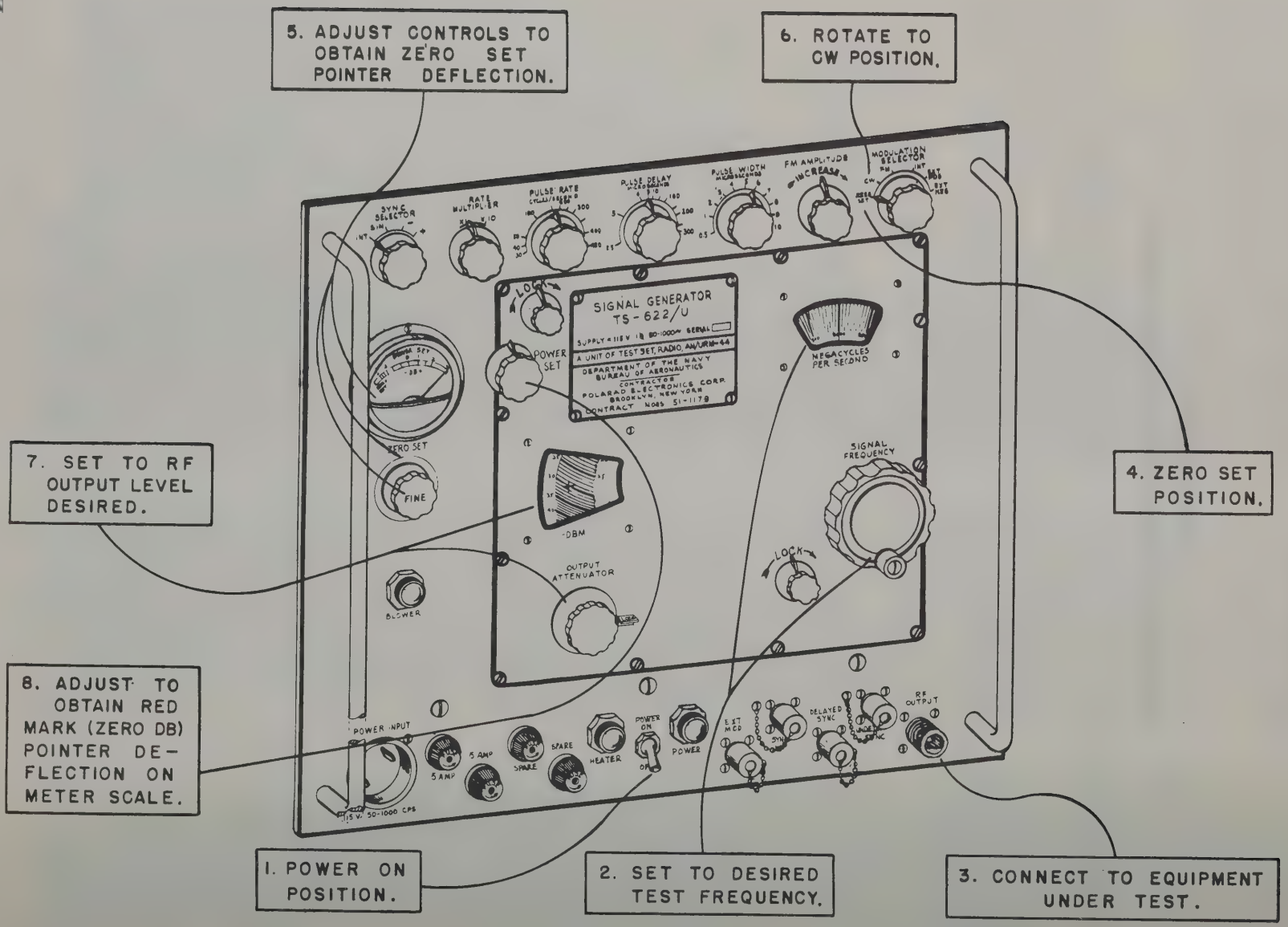


Figure 3–1. Signal Generator TS-622/U, Initial Calibration Procedure

3–6. RECALIBRATING POWER LEVEL OUTPUT.

3–7. During operation, if it becomes necessary to change the frequency setting of SIGNAL FREQUENCY control, the power level output should be recalibrated. Perform recalibration procedure as directed below:

a. Turn MODULATION SELECTOR to ZERO SET.

b. Adjust ZERO SET coarse and ZERO SET FINE until pointer of power monitor meter deflects to the left-hand index of the scale.

c. Turn MODULATION SELECTOR to CW.

d. Set OUTPUT ATTENUATOR control to desired value.

e. Adjust POWER SET control until pointer of the power monitor meter deflects to the red-line calibration mark. If a zero-db setting cannot be obtained, determine the actual level of r-f test signal at the RF OUTPUT receptacle by adding (algebraically) the output attenuator dial reading to the POWER SET meter reading.

3–8. PREPARATION FOR RESHIPMENT.

3–9. To prepare the test set for reshipment, proceed as directed below:

a. Remove power cord CX-337/U(6') from the power source outlet and from the POWER INPUT receptacle on the front panel of the signal generator. Store the power cable in the stowage compartment, located in the right-hand section of the transit case.

b. Disconnect r-f cable CG-92B/U from any external equipment which has been undergoing test and from the RF OUTPUT jack J13, in the lower right section of the signal generator front panel. Store the r-f cable in the transit case stowage compartment.

c. If video cords CG-409/U are connected to any external equipment, disconnect them from the equipment undergoing test, and from the SYNC, and EXT MOD, jacks located in the lower right section of the signal generator front panel. Be sure to place the video cords in the transit case stowage compartment for re-use with the equipment.

d. After checking that all cables have been removed from the test set front panel, grasp the equipment by its two handles on the front panel, and lower it into the main compartment of the transit case. Place the cover over the top of the case, and latch the ten hooks on the main body of the case securely on to the hooks on the cover. The equipment is now ready for transit.

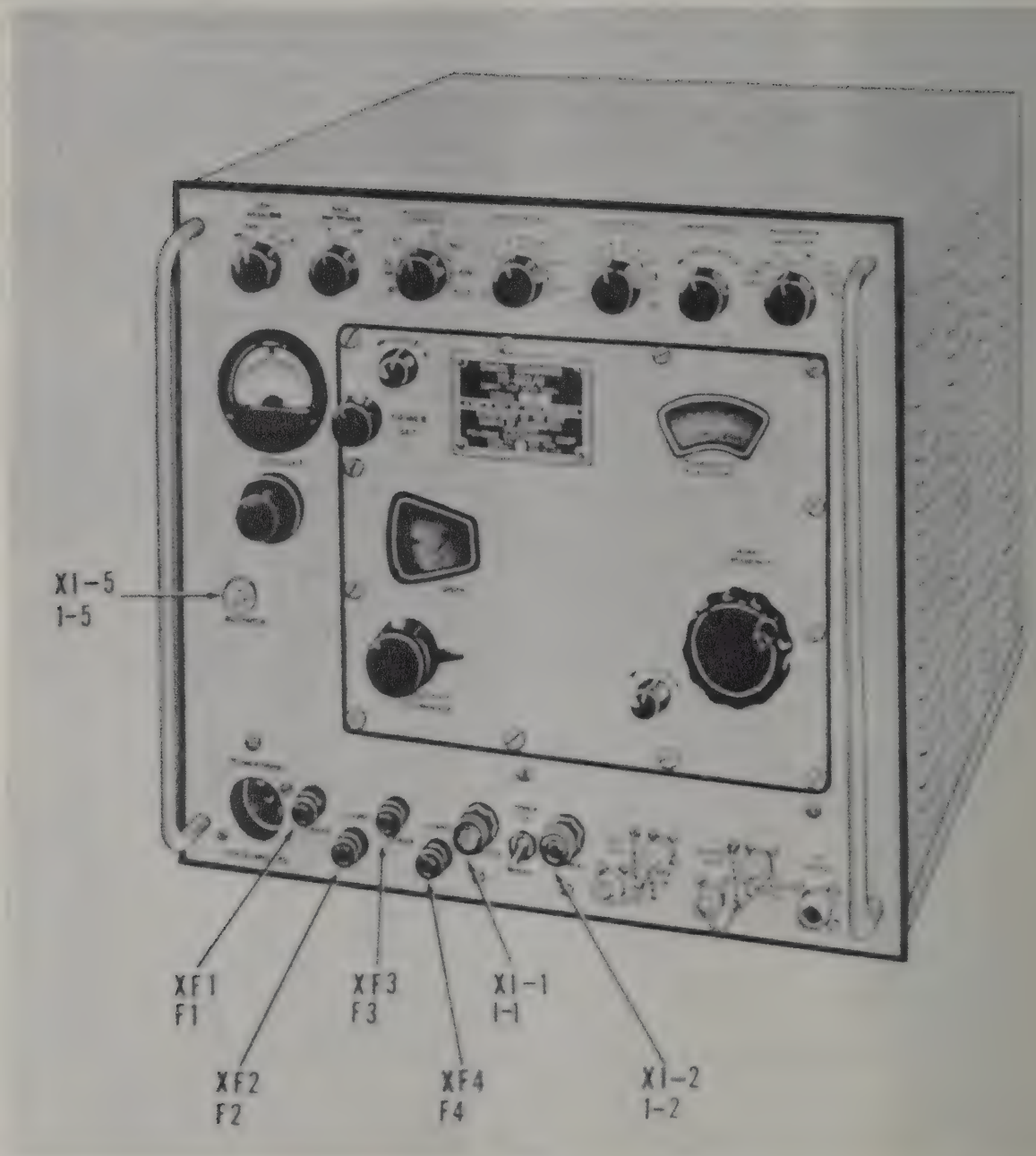


Figure 4–1. Fuse and Pilot Lamp Location

SECTION IV

EMERGENCY OPERATION AND REPAIR

4-1. EMERGENCY OPERATION.

4-2. Since Radio Test Set AN/URM-44 is a test equipment, no emergency operation is permissible. Any malfunctioning of the signal generator will warrant suspending use of the equipment until such time as necessary corrective measures have been taken in accordance with the Handbook of Service Instructions for Radio Test Set AN/URM-44.

4-3. OPERATOR'S MAINTENANCE.

4-4. CRYSTAL UNITS. All of the crystal units contained in Signal Generator TS-622/U are of the solder-lead type. Therefore, no attempt should be made by the operator to replace them.

4-5. REPLACING FUSES. (*See figure 4-1.*) The two active fuses, F1 and F2, are located in receptacles XF1 and XF2 on the front panel of the signal generator. If replacement of either or both of these fuses is indicated, replacement should be made with one or both of the spare fuses (F3 and F4), located in receptacles XF3 and XF4 immediately to the right of the active fuse receptacles. A new fuse should be placed in the spare receptacle as soon as convenient after the original spare has been placed in service.

CAUTION

Do not replace a fuse with one of higher rating unless continued operation is more important than probable damage to the equipment. If a fuse blows immediately after replacement, do not replace it a second time until the cause of malfunctioning has been determined and remedied by service personnel.

4–6. REPLACING PILOT LAMPS. (*See figure 4–1.*)

4–7. Pilot lamps I-1, I-2, and I-5 are located within the front panel indicators designated HEATER (XI-1), POWER (XI-2), and BLOWER (XI-5). Replacement may be made by unscrewing the knurled caps on the front panel, and removing the defective lamp. Miniature bayonet base type 47 incandescent lamps are used as I-1 and I-2. A type NE51 neon lamp, with bayonet base, is employed as I-5.

4–8. REMOVING FRONT PANEL AND CHASSIS FROM EQUIPMENT CASE.

4–9. To replace all vacuum tubes and dial lamps I-3 and I-4, the front panel and chassis must be removed from the equipment case. This procedure is best accomplished in the following manner:

a. Invert the signal generator so that the rear of the equipment dust cover faces upward, and the two nickel-plated guard rails on the front panel rest against the work bench or deck.

b. One slot-drive cam-lock fastener is located at each corner at the rear of the dust cover case. Release the locks by turning each with a screwdriver or thin coin one-quarter turn counterclockwise.

c. Slide the equipment dust cover upwards, until it has cleared the rear of the chassis. Place the dust cover case on a convenient work bench.

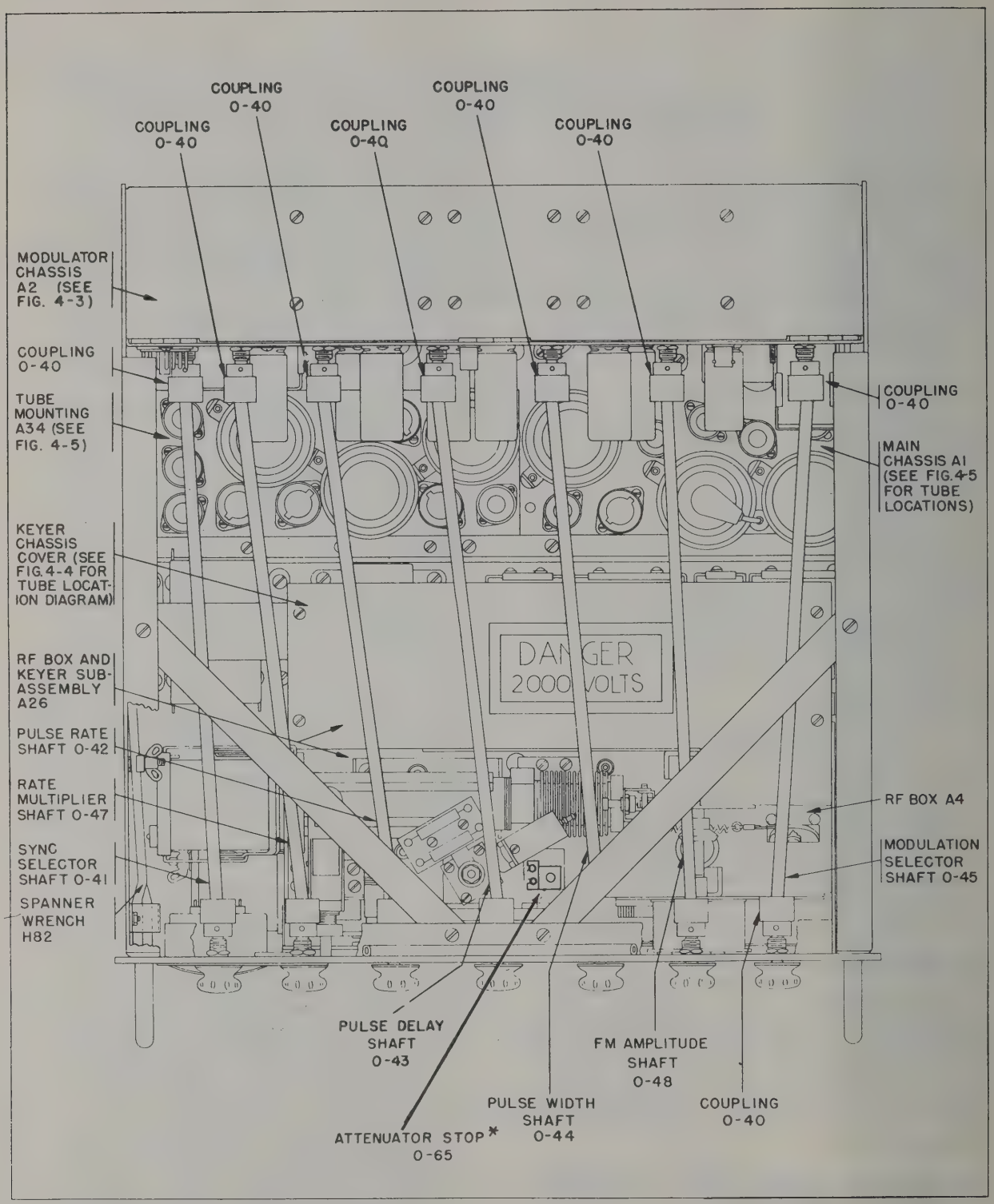
d. The component parts on the signal generator front panel and chassis which may require replacement or adjustment by service personnel will now be visible and accessible.

4–10. REPLACING VACUUM TUBES.

4–11. All tubes, except for the type 5721 reflex klystron oscillator V13, may be replaced by organizational and operational maintenance units. These personnel are cautioned not to attempt replacement of oscillator tube V13, since recalibration of the equipment will then be required, as outlined in the Handbook of Overhaul Instructions. All other vacuum tubes are accessible after the front panel and chassis has been removed from its equipment case, as directed in paragraph 4–9, above. Figure 4–2 shows a top view of the signal gentrator, removed from its equipment dust cover case.

WARNING

Operation of this test equipment involves the use of high voltages (2000 volts) which are dangerous to life. Operating personnel must observe all safety regulations at all times. Do not change tubes or make adjustments of the chassis controls with the voltage supply on. Always remove the power cable plug P401 from its receptacle J14 before making any repairs, or attempting to replace tubes and dial lamps. Although bleeder circuits are used to prevent capacitors from retaining charges after the power has been disconnected, always discharge and ground circuits before touching them in order to avoid injury.



*Added if modified by FSN R5800K-URM44-CHI

Figure 4–2. Top view of Signal Generator, Removed from Equipment Case

4–12. TUBE REPLACEMENT, MODULATOR CHASSIS. The modulator chassis is at the rear of the equipment, with the tubes oriented in a horizontal plane. Figure 4–3 is a tube location diagram of the modulator. The type 12AT7 tubes V1, V2, V3, V6, and V7 are accessible through the large opening towards the rear of the left side bracket of the equipment. The type 12AT7 tubes V4, V5, and the type 6AK6 tubes V8, V9 are most easily accessible through the large opening at the center of the right side bracket of the equipment. Each tube on the modulator chassis is provided with a round, metal, open top, bayonet type mounted shield. To remove this shield, depress it in towards the chassis, and turn it slightly counterclockwise. The spring loaded mechanism at the top of the shield will then be released, and the shield may now be removed.

4–13. TUBE REPLACEMENT, KEYER CHASSIS. At the approximate center of the main chassis (see figure 4–2), is the keyer chassis, which is raised above the main deck by the frame of the r-f box, to which it is attached. The keyer chassis is illustrated in figure 4–4. To gain access to the tube compartment, it is only necessary to remove the metal cover of the keyer chassis, which is secured to the frame by means of four no. 6-32 cadmium plated, steel, binding head machine screws. Reference to figure 4–4 shows that the type 12AT7 keyer tube, V11, is located closest to the rear of the chassis; the type 6X4W protective diode V12 is adjacent to tube V11; and the type 6AU6 pulse amplifier tube V10 is closest to the front wall of the chassis. Each of the tubes in the keyer chassis is provided with the same type of spring-loaded shield as is used in the modulator. To remove the shield, depress it in towards the right side wall of the equipment, and turn the shield slightly counterclockwise. The spring-loaded mechanism at the top of the shield will now be released, and the shield may be removed. In replacing the shield over a replacement tube, be sure to reverse this procedure.

4–14. TUBE REPLACEMENT, MAIN DECK OF CHASSIS. Figure 4–5 is a tube location diagram of the main deck of the chassis. For purposes of clarity, this illustration shows the main deck after the modulator chassis, keyer, and r-f box have been removed from the deck. Organizational and operational maintenance personnel are cautioned that replacement of tubes does not require the removal of these subassemblies. In fact, removal of any of them will require recalibration of the equipment, which is a complex procedure to be performed by Overhaul and Repair Unit personnel only. All tubes on the main deck of the chassis are accessible for replacement purposes from the rear, the two large openings in the left side bracket of the equipment, and the single large opening in the right side bracket of the equipment. Follow the procedure outlined below:

a. Use the opening towards the rear of the left side bracket to replace all tubes in the keyer power supply, comprising tubes V14 through V18, in the repeller power supply, comprising tubes V19 through V23, and in the voltage doubling circuit of the beam power supply, comprising tubes V24 and V25. The type 5R4WGY tubes V19, V24, and V25 are held in place by "top hat" clamps which retain each tube positively with minimum rigidity and strain on the glass envelope. To release the tube clamp, it is only necessary to use the index finger of one hand, and bend the spring at the side of the clamp in, towards the threaded post on which it rests. While holding the spring in this depressed position, lift the clamp completely clear of its post.

b. Use the opening at the center of the right side bracket to replace the remaining tubes of the beam power supply, tubes V26 through V31, and the rectifier, control tube, and series regulator, tubes V34, V35, and V37, in the 250-volt positive power supply. In replacing the type 807 series regulator tube V26, be sure to remove the plate clip from the top of the tube before attempting to remove the tube clamp. Tubes V26, V34, and V37 employ "top hat" retaining clamps, which are to be removed as directed in sub-paragraph a., immediately above.

c. Turn the chassis around so that the rear of the equipment is accessible, in order to replace the two type 807 tubes V32, V33, in the blower multivibrator circuit, and the type OB2 voltage reference tube V36, in the positive 250-volt power supply. The type 807 tubes have clips attached to their plate electrodes at the top of the glass envelope. Be sure to remove the clip, before releasing the "top hat" retaining clamp, as directed in sub-paragraph a. above. The 400 cycle multivibrator circuit is removed if the Radio Test Set is modified by FSN R5800K-URM44-CHI.

d. Use the opening towards the front of the left side bracket in order to replace the r-f power monitor tubes V38 (type 6AU6) and V39 (type 6AK6). These two tubes are directly to the rear of METER SELECTOR S6, as illustrated in figure 4–5, and are provided with round, metal, open top tube shields. To remove the shield, depress it towards the floor of the main chassis, and turn the shield slightly counterclockwise. The shield may then be lifted from its position over the tube. In replacing the shield over the new tube, be sure to depress the shield over the bayonet protrusions on the sides of the tube socket. Then give the shield a slight clockwise twist, until a definite stop is reached.

Note

All tubes of a given type supplied with the equipment shall be consumed prior to employment of tubes from general stock.

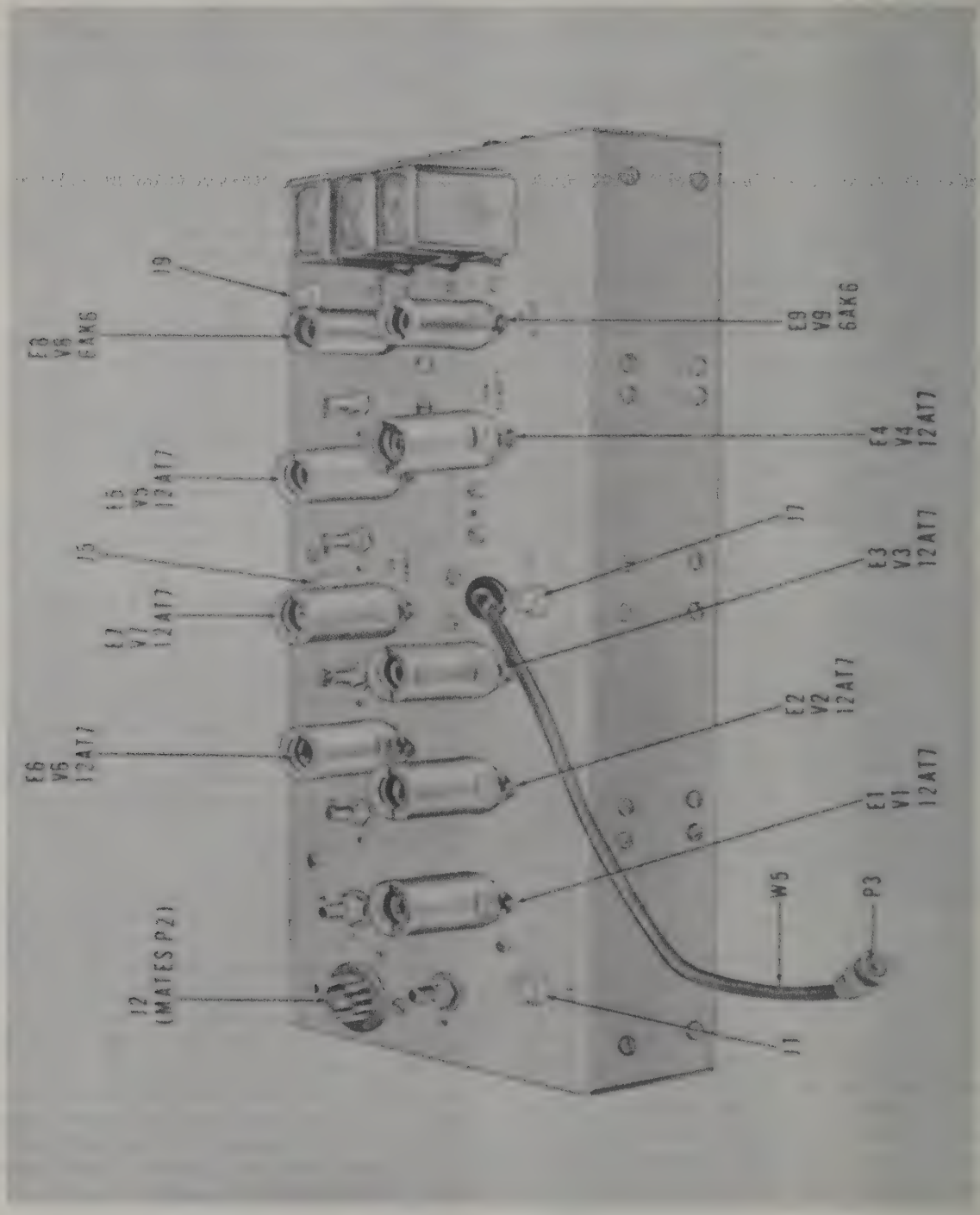


Figure 4–3. Modulator, Tube Location Diagram

4–15. REPLACING DIAL LAMPS.

4–16. If replacement of the SIGNAL FREQUENCY dial lamp I-3 or OUTPUT ATTENUATOR dial lamp I-4 is required, access may be gained to these lamps by removing the front panel and chassis from the equipment dust cover case as directed in paragraph 4–9, above. Both dial lamps are type 47 incandescent bulbs, and are located on brackets directly to the rear of their associated dials. Proceed as follows:

a. REPLACEMENT OF SIGNAL FREQUENCY DIAL LAMP I-3. With the chassis removed from its equipment case, dial lamp I-3 is accessible from the top of the main chassis. Figure 4–6 shows that lampholder XI-3 is secured to frequency dial bracket assembly A10 by means of a single no. 6-32 binding head screw, lock washer, and plain washer. After removing the screw and its washers, gently pull the lampholder XI-3 back, towards the rear of the chassis, until it is free of the mounting bracket. Press the defective lamp deeper within its lampholder, turn the bulb in its retaining socket, and remove the lamp. Replace with a new type 47 lamp, known to be in good working order. Then reassemble lampholder XI-3 to its mounting bracket A10, so that the new lamp will illuminate the frequency dial through the 7/16″ diameter hole provided in the plexiglass dial window.

CAUTION

Do not attempt to remove the frequency dial index window in the above procedure. Failure to observe this precaution will result in the need for recalibration of the frequency dial. In addition, use care in reassembling the lampholder to its mounting bracket, so that its binding head screw and washers do not drop into the r-f box chassis.

b. REPLACEMENT OF OUTPUT ATTENUATOR DIAL LAMP I-4. With the chassis removed from its equipment case, dial lamp I-4 is also accessible from the top of the main chassis. Figure 4–6 shows that lampholder XI-4 is secured to oscillator support sub-assembly A5 by means of a single no. 6-32 binding head screw, lock washer, and plain washer. Remove this screw and its washers from the top of the support sub-assembly and gently pull the lampholder XI-4 back, towards the rear of the chassis, so that the lampholder can be easily manipulated. Press the defective bulb further into its retaining socket, and remove the lamp. Replace with a new type 47 lamp, known to be in good working order. Then reassemble lampholder XI-4 to the sub-assembly A5, so that the new lamp will illuminate the attenuator dial.

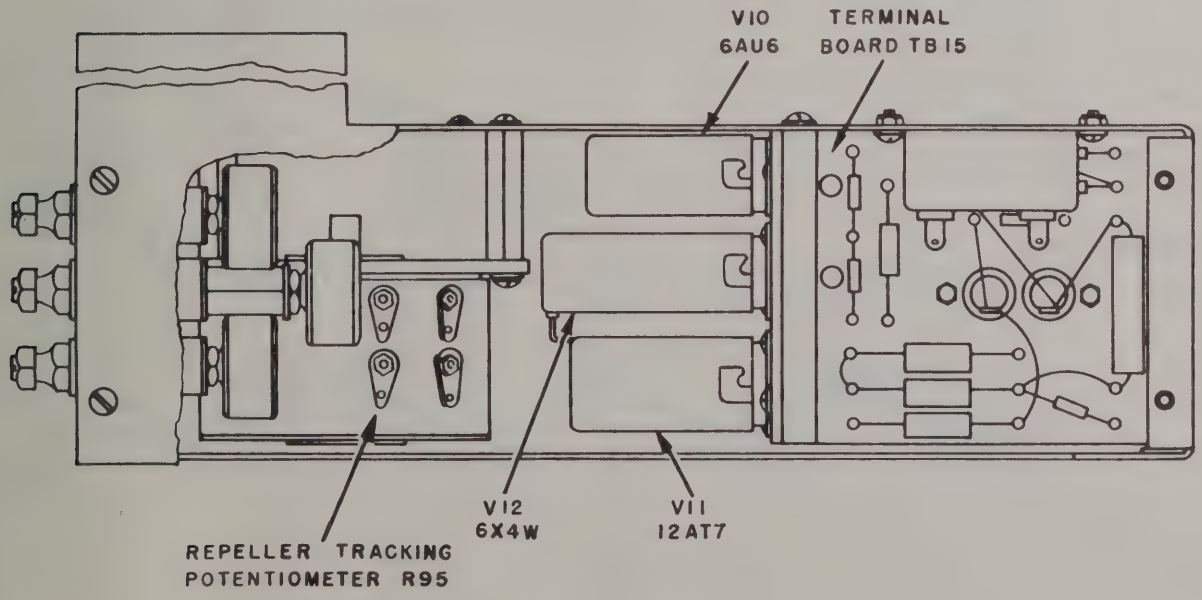


Figure 4–4. Keyer, Tube Location Diagram

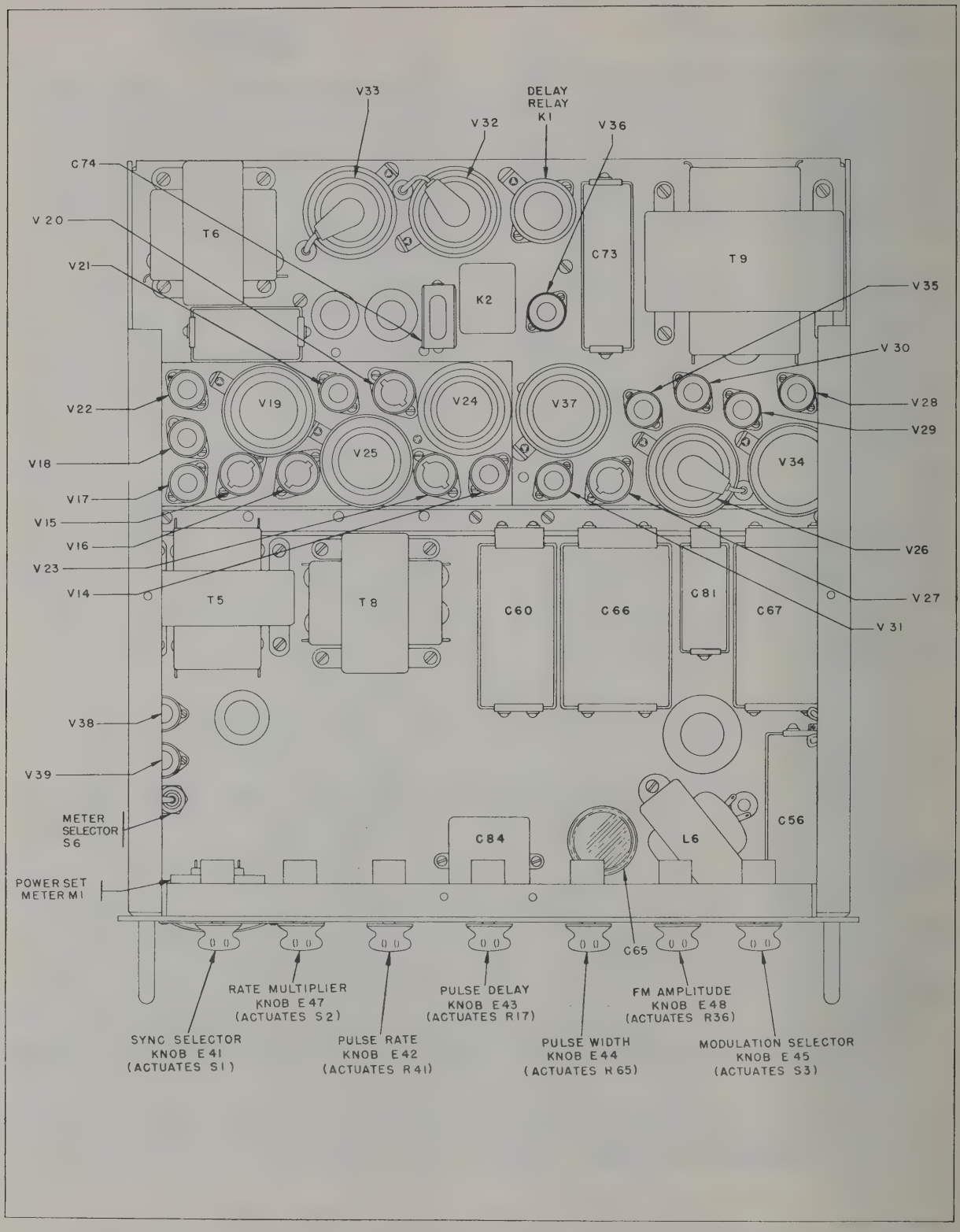


Figure 4–5. Main Chassis, Tube Location Diagram

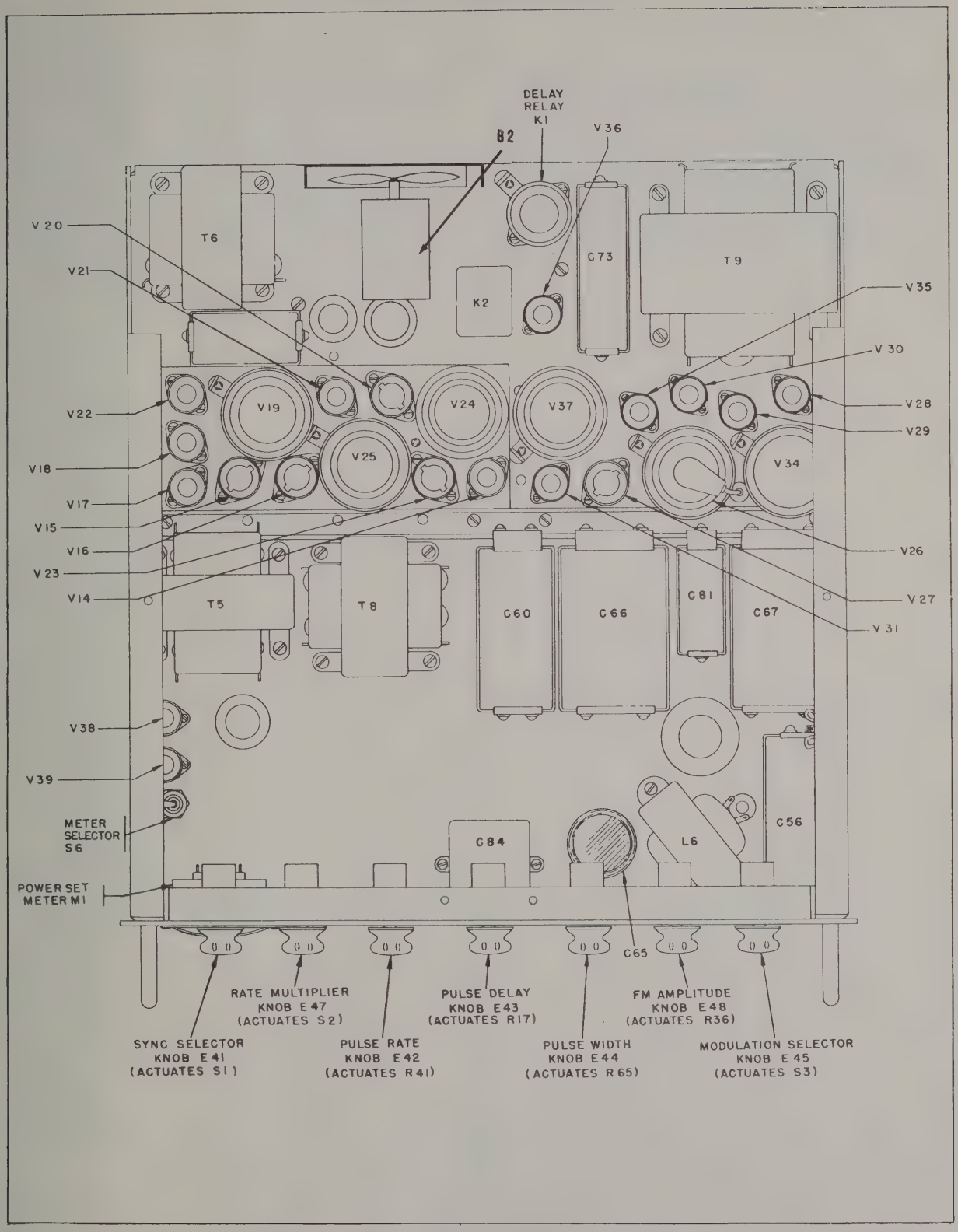
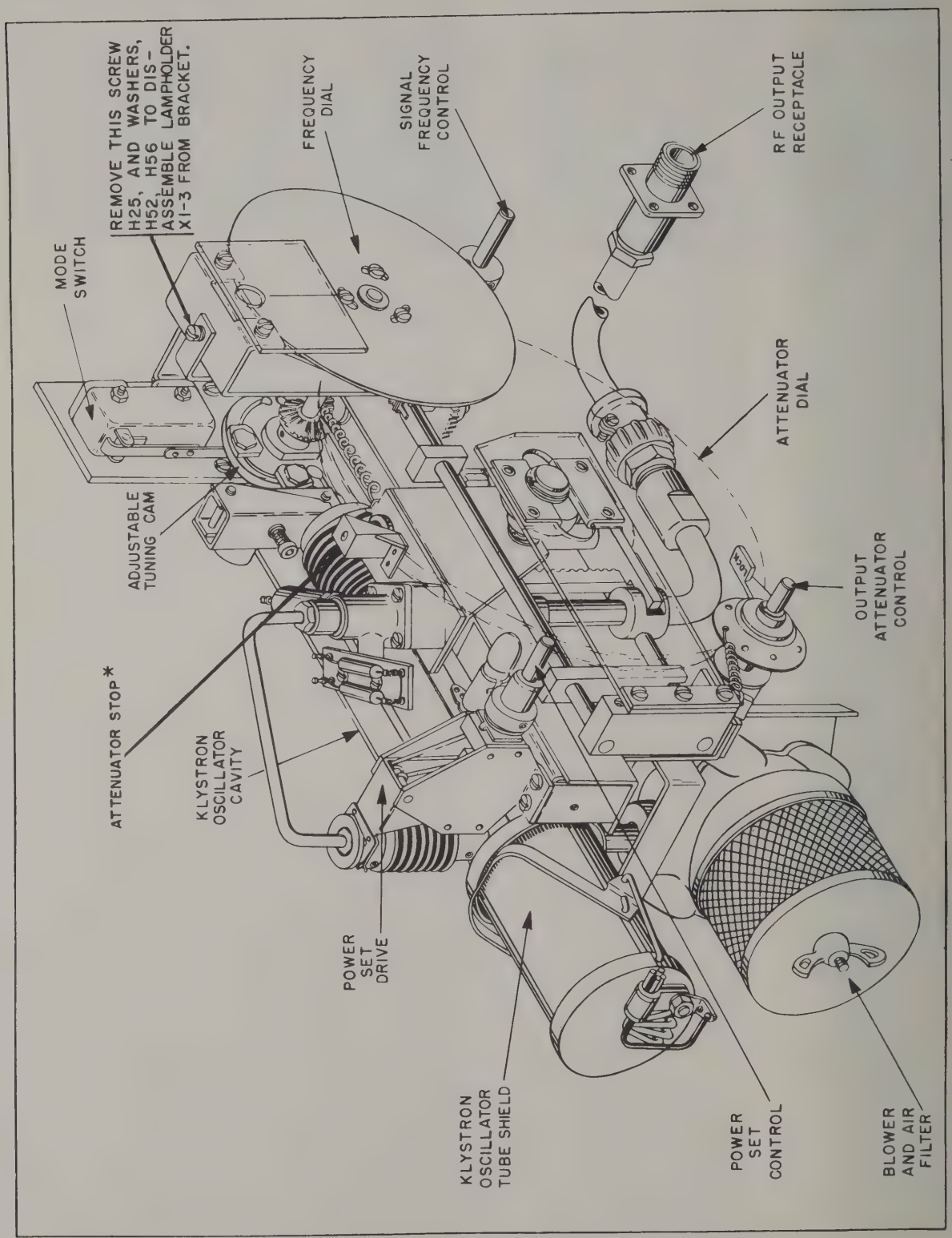


Figure 4—5A. Main Chassis, Tube Location Diagram

(as modified by FSN R5800K-URM44-CHI)

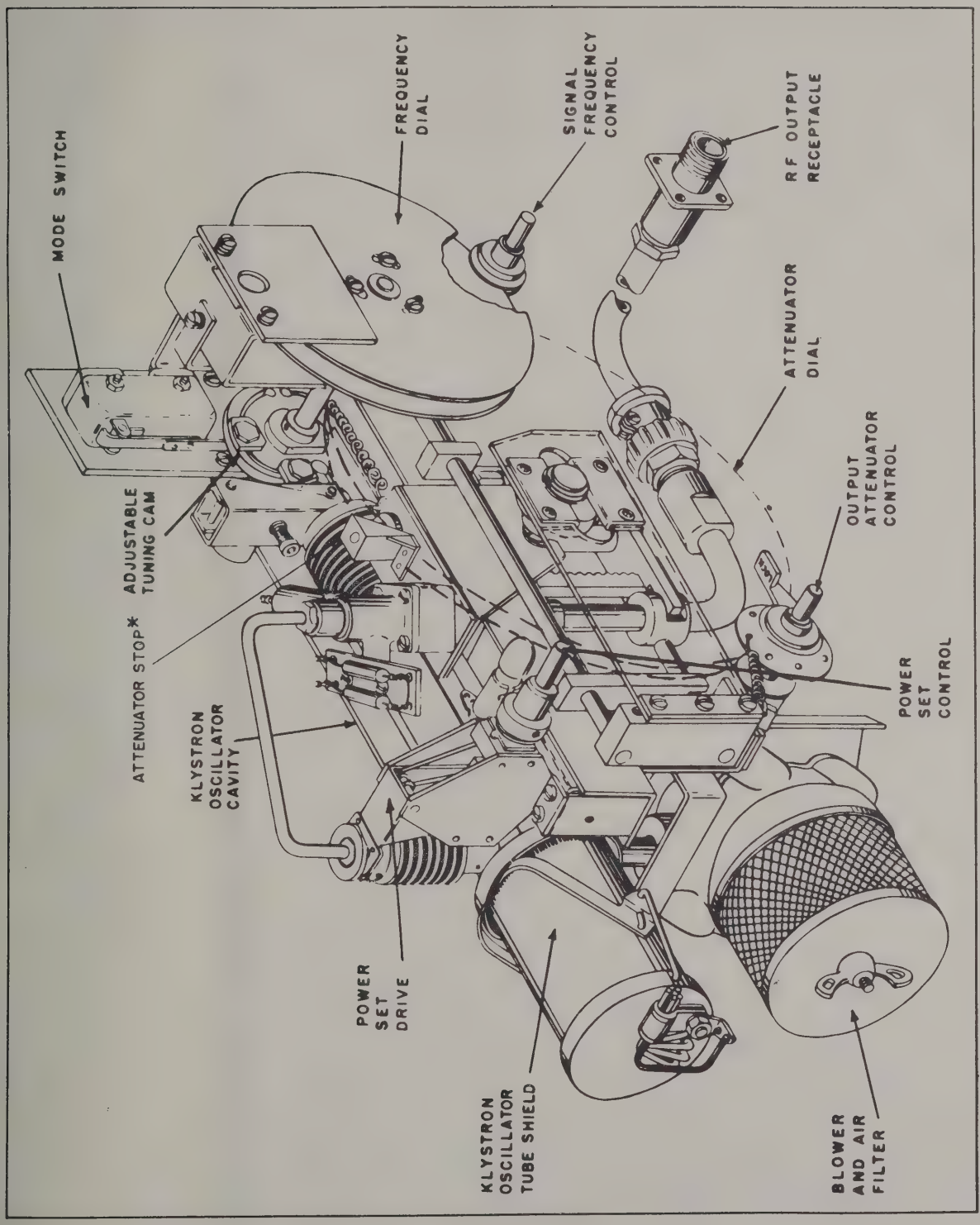
4–17. IMPEDANCE MATCHING.

4–18. When using Signal Generator TS-622/U, it must be remembered that the external load on the instrument should be 50 ohms resistive for best accuracy in measurements. The OUTPUT ATTENUATOR dial has been calibrated by using a 50-ohm load. At the same time, the internal impedance of the generator has been maintained close to 50 ohms. These facts combine to give an accuracy of output power level from the instrument of within a fraction of a decibel, provided a 50-ohm resistive load is used. To obtain the highest accuracy in power level measurements, the standing wave ratio in the line to the load should always be minimized. A sometimes-overlooked factor which contributes error in high-frequency measurements is the improper assembly of coaxial connectors. A standing wave ratio of several db, with attendant error, can often be attributed to this cause. For proper repair or fabrication of r-f cable CG-92B/U(6′), as well as for video cables CG-409/U(8′), refer to figures 7–8 and 7–9 in the Handbook of Service Instructions for this equipment.



*Added if modified by FSN R5800K-URM44-CHI

Figure 4–6. R-F Box Dial Lamp Location Diagram (Contract No. NOas 51-1179)

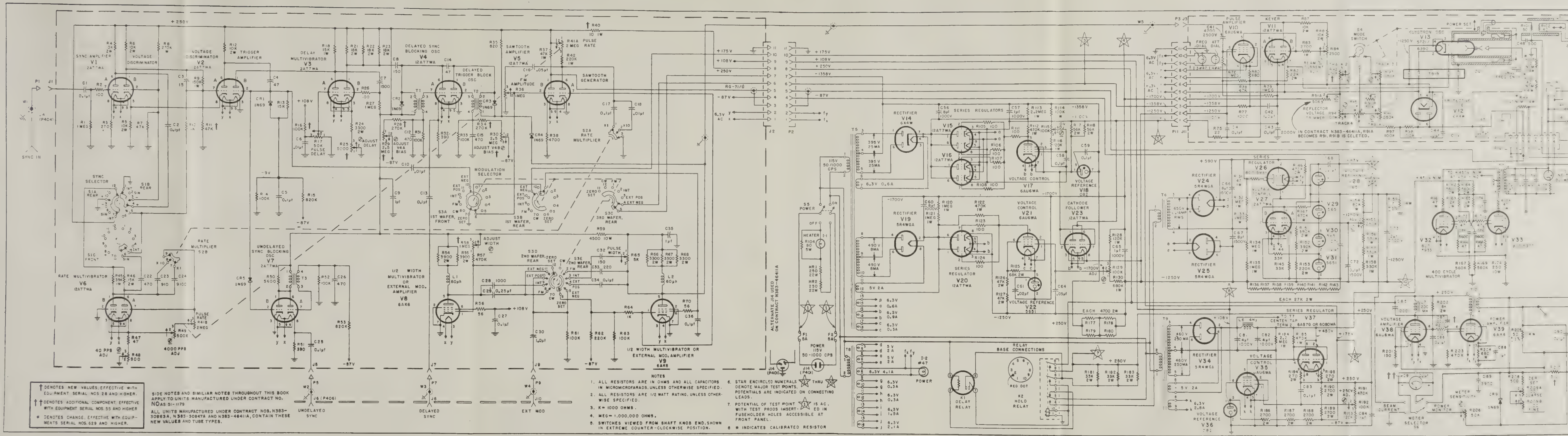


*Added if modified by FSN R5800K-URM44-CHI

Figure 4-6A. R-F Box, Dial Lamp Location Diagram (Contract No. N383-30863A, N383-30847A, N383-46411A)

* U.S. GOVERNMENT PRINTING OFFICE : 1961 O—589742

ALTERNATE, J14 USED



† DENOTES NEW VALUES, EFFECTIVE WITH EQUIPMENT SERIAL NOS. 28 AND HIGHER.

†† DENOTES ADDITIONAL COMPONENT, EFFECTIVE WITH EQUIPMENT SERIAL NOS. 55 AND HIGHER

* DENOTES CHANGE, EFFECTIVE WITH EQUIPMENTS SERIAL NOS. 629 AND HIGHER.

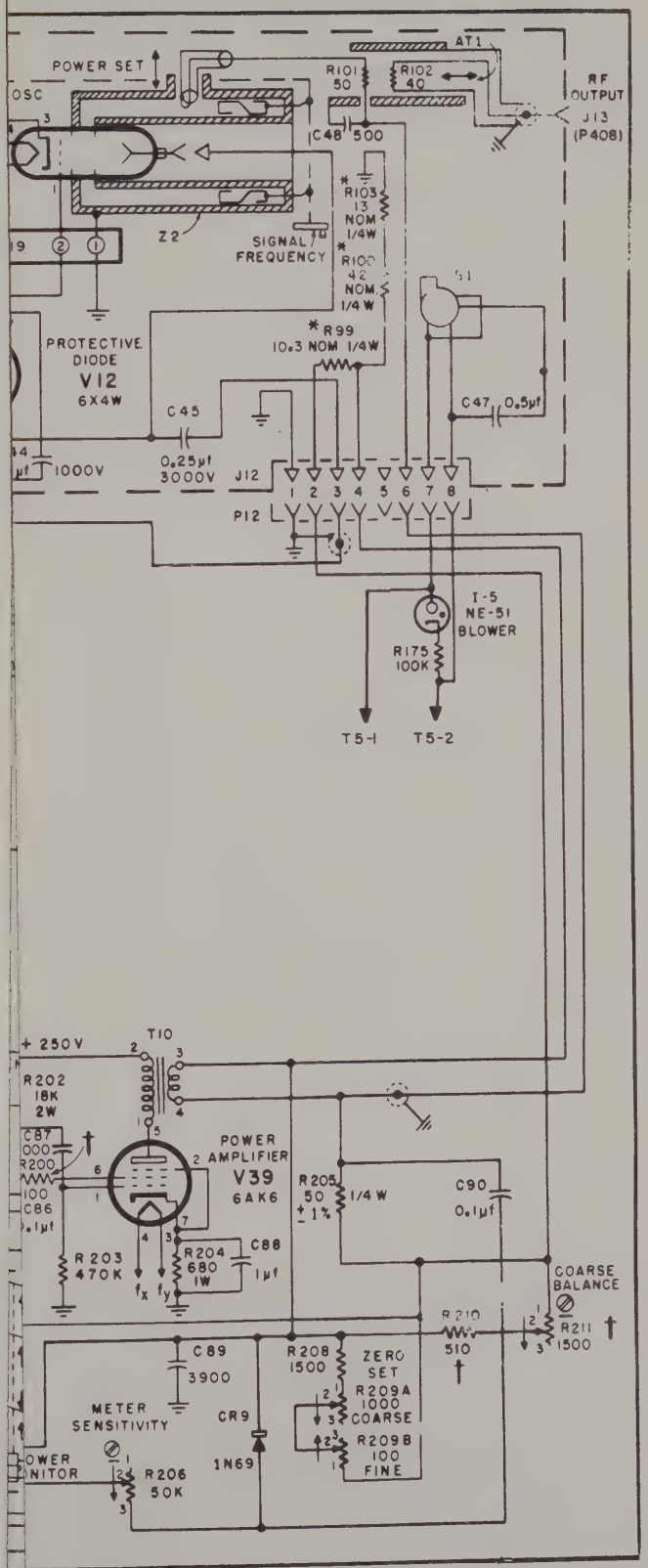
SIDE NOTES AND SIMILIAR NOTES THROUGHOUT THIS BOOK APPLY TO UNITS MANUFACTURED UNDER CONTRACT NO. NOas 51-1179

ALL UNITS MANUFACTURED UNDER CONTRACT NOS. N383-30863A, N383-30847A AND N383-46411A, CONTAIN THESE NEW VALUES AND TUBE TYPES.

NOTES

1. ALL RESISTORS ARE IN OHMS AND ALL CAPACITORS IN MICROMICROFARADS, UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE 1/2 WATT RATING, UNLESS OTHERWISE SPECIFIED.
3. K = 1000 OHMS.
4. MEG = 1,000,000 OHMS.
5. SWITCHES VIEWED FROM SHAFT KNOB END, SHOWN IN EXTREME COUNTER-CLOCKWISE POSITION.
6. STAR ENCIRCLED NUMERALS (2) THRU (10) DENOTE MAJOR TEST POINTS. POTENTIALS ARE INDICATED ON CONNECTING LEADS.
7. POTENTIAL OF TEST POINT (1) IS AC, WITH TEST PRODS INSERTED IN FUSEHOLDER HOLES ACCESSIBLE AT FRONT PANEL.
8. * INDICATES CALIBRATED RESISTOR

Figure 4-7. Signal Generator TS-622/U. Schematic Circuit Diagram



TS-622/U, Schematic Circuit Diagram

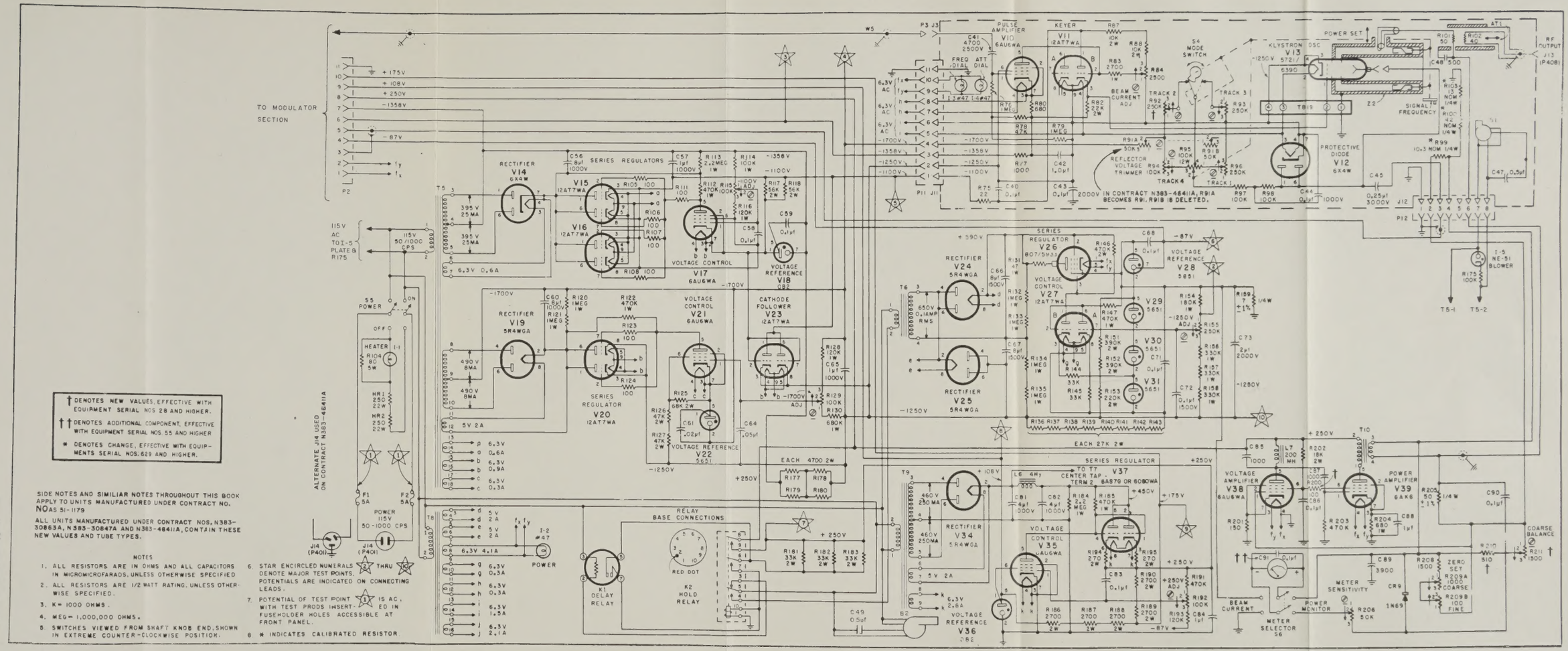


Figure 4-7A. Signal Generator TS-622/U, Schematic Circuit Diagram